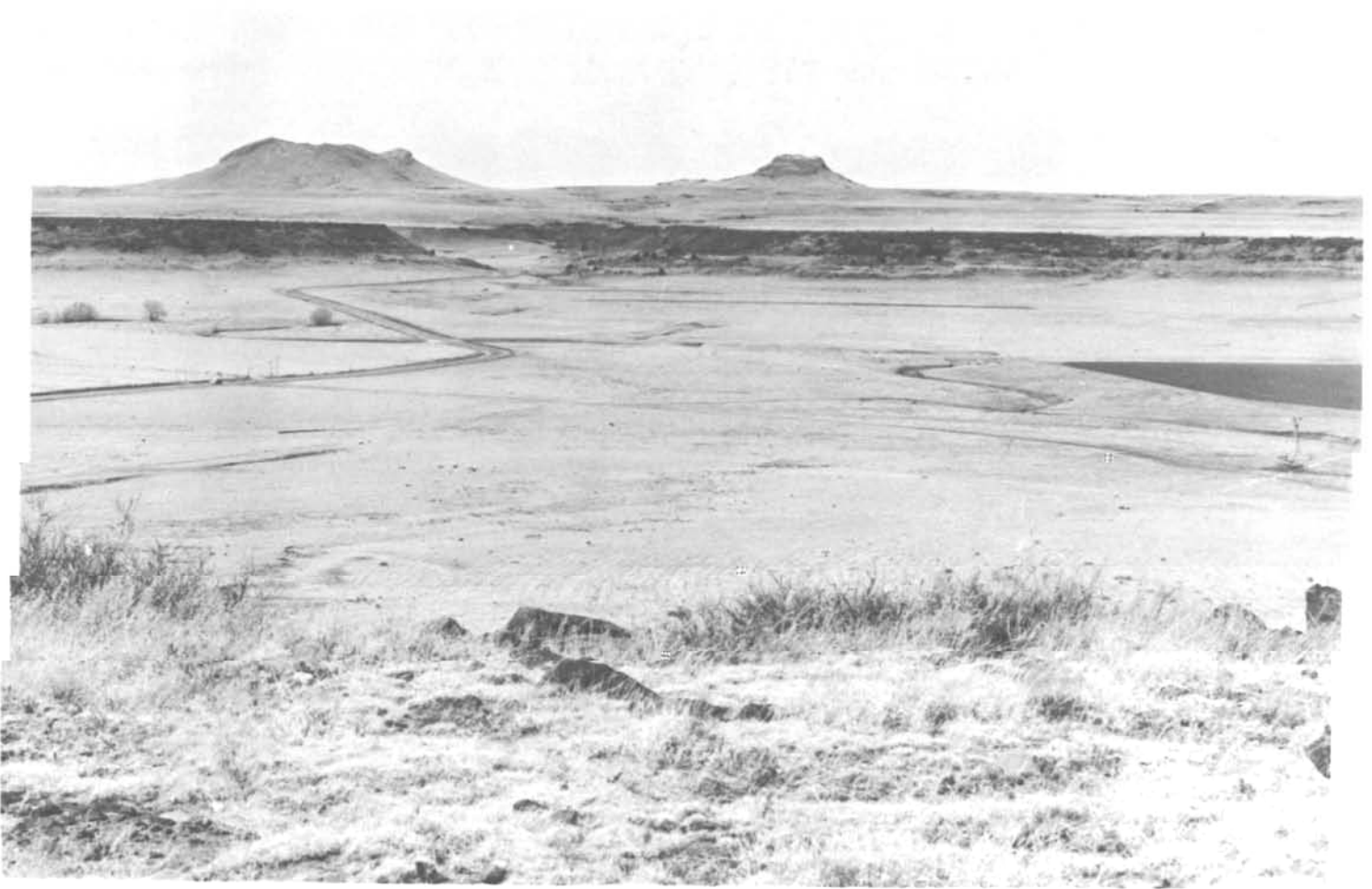


SOIL SURVEY OF

Union County, New Mexico



United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
New Mexico Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1956-71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service, Forest Service, and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Northeastern and Ute Creek Natural Resource Conservation Districts.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming and industry.

Locating Soils

All the soils of Union County are shown on the detailed map at the back of this publication.

used along with a published soil survey from an adjoining area, the soils may have different names even though they appear to be the same.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for erosion use can be colored brown, those

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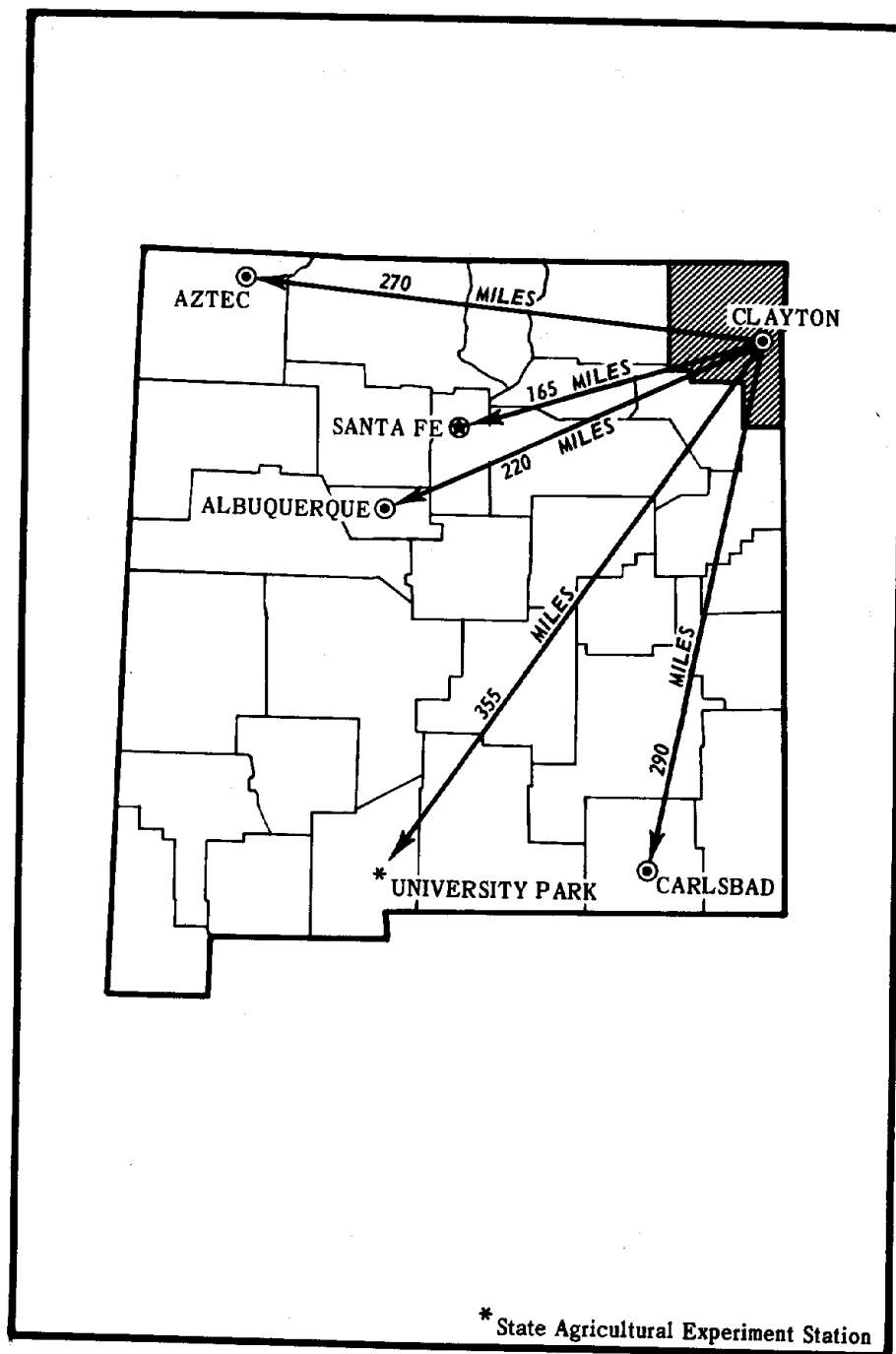
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Location of Union County in New Mexico.

SOIL SURVEY OF UNION COUNTY, NEW MEXICO

By Harold B. Maxwell, Steven P. Shade, Hayden D. Rounsaville, and Abe Stevenson, Soil Conservation Service¹

United States Department of Agriculture, Soil Conservation Service, and Forest Service, in cooperation with New Mexico Agricultural Experiment Station

UNION COUNTY is in the extreme northeastern corner of New Mexico (see facing page.) The land area of the county is 2,442,880 acres, or about 3,817 square miles. Clayton, the county seat, is in the east-central part of the county. The Cimarron River runs west to east across the north end of the county. Many local residents refer to it as the Dry Cimarron River. Other drainage outlets include Ute and Tramperos Creeks to the south.

About 95 percent of the county is used for grassland. Ranching is the main enterprise, and beef cattle is the dominant livestock (5).² A very few herds of sheep are in the county. Most ranches have a few horses that are used primarily for herding cattle.

About 3.5 percent of the county is used for non-irrigated cropland, and about 1.5 percent is used for

with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in this survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dallam and Gruver, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior

dominant soils, and the pattern and relative proportions are about the same in all areas. Generally the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Guy-Textline complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. A considerable degree of uniformity in pattern and relative extent of the dominant soils exists, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Ayon-Apache association is an example.

In most areas surveyed there are places where the soil material is so stony, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land areas or are named for a higher category in the soil classification system and are given descriptive names. Ustolls-Rock outcrop association has the name Ustolls from the suborder level of the soil classification system and Rock outcrop is a land area.

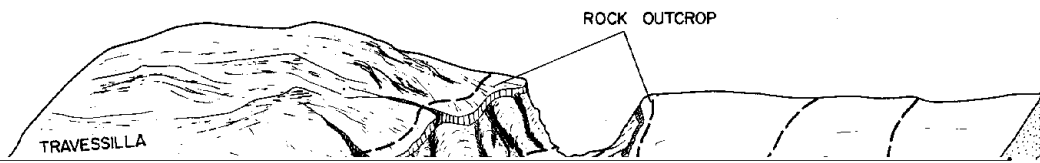
While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field trials.

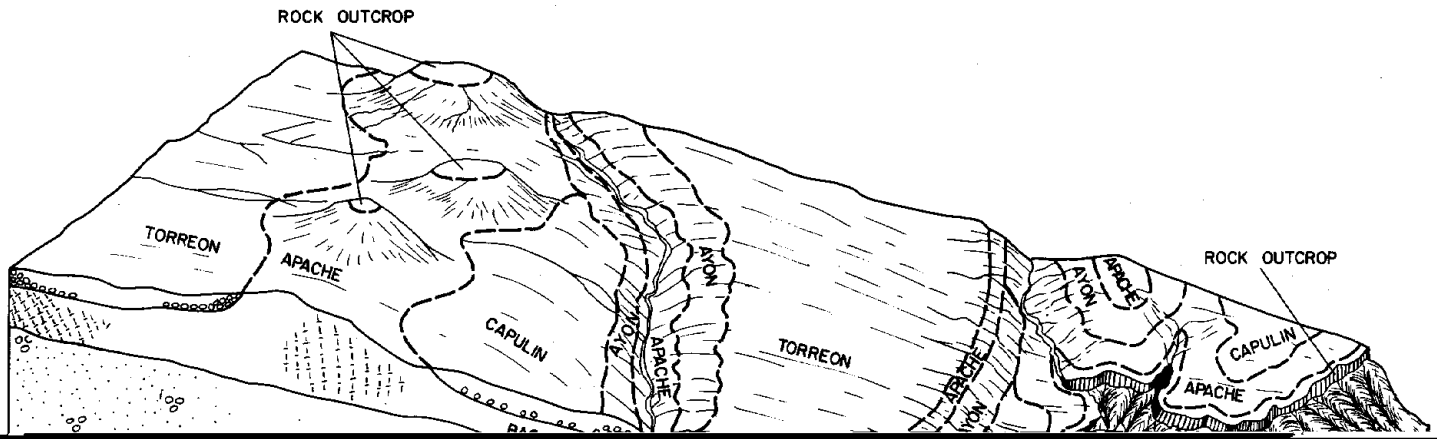
pattern of soils in defined proportions. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use (6). Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting a site for a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations as described in Union County have more detail than those of the adjoining counties in Texas and Oklahoma. Because of this, the boundary lines of mapping units in Union County do not always join those in Texas and Oklahoma.

Each of the soil associations in Union County is discussed in the following paragraphs. The terms for texture in the title of several associations apply to the texture of the surface layer. For example, in the title of association 7, the words loam and clay loam refer to the texture of the surface layer.





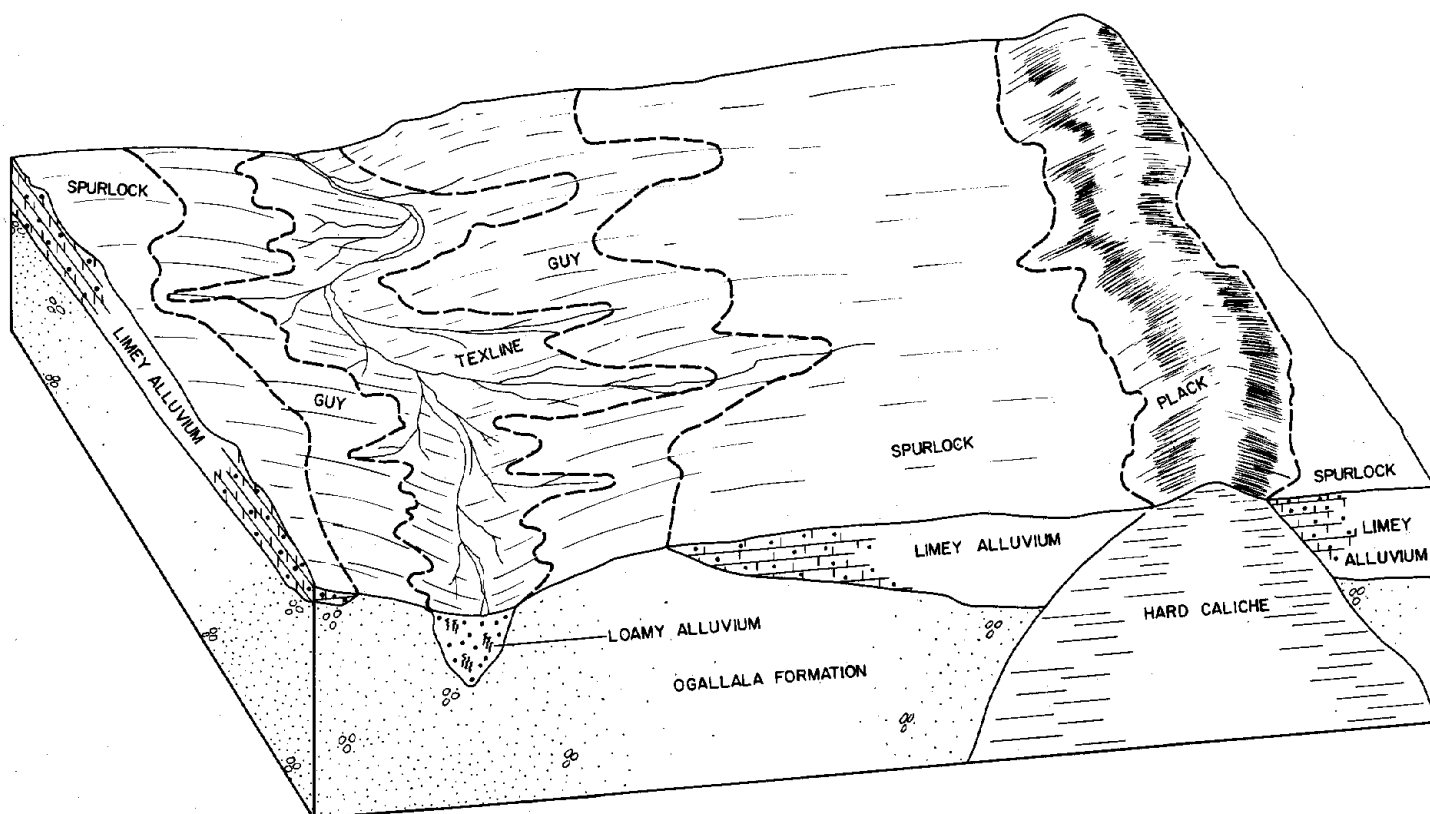
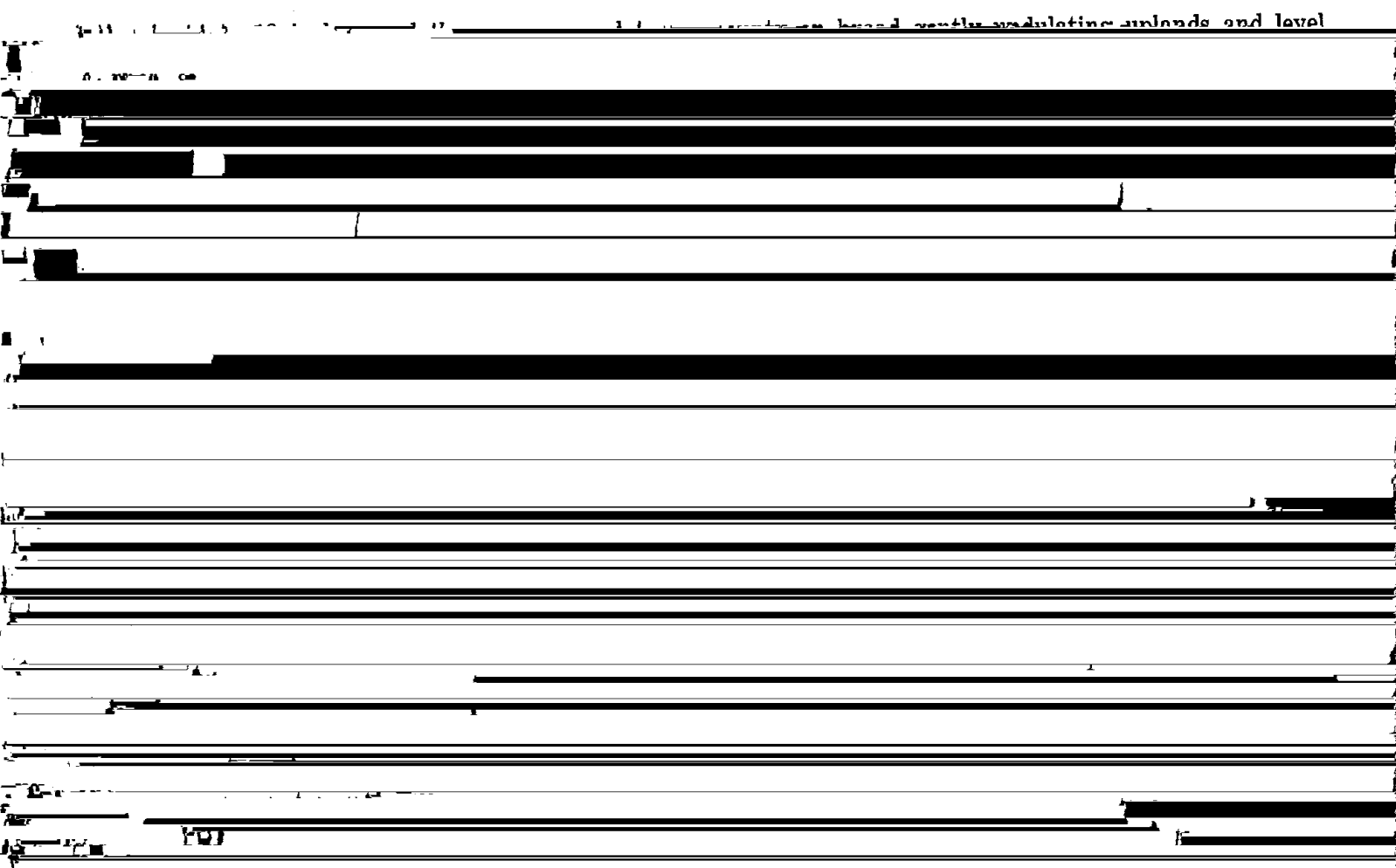


Figure 3.—Typical pattern of the soils in association 3.



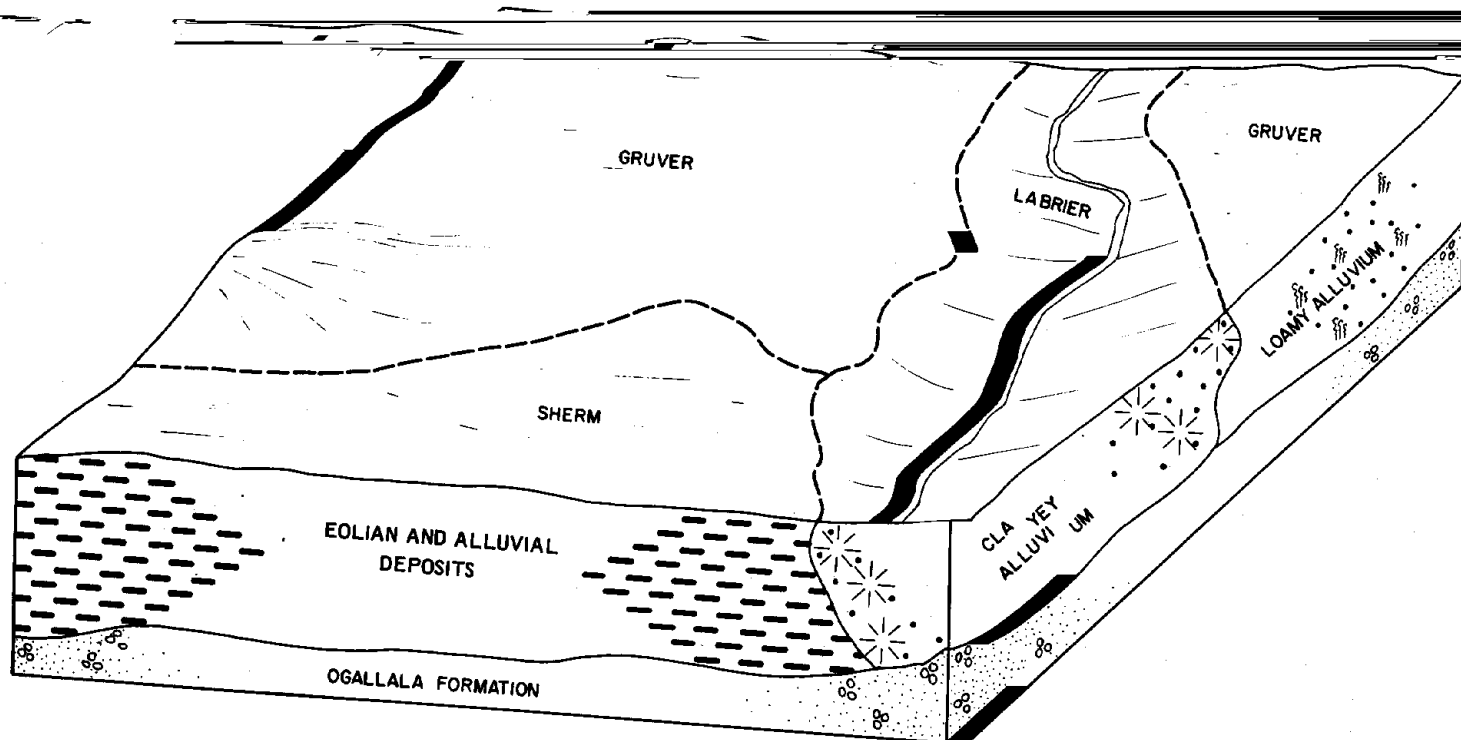


Figure 4.—Typical pattern of the soils in association 5.

because of the nearly level slopes and very slow permeability. The principal crops are grain sorghum, alfalfa hay, and corn. In places management that controls runoff and erosion is needed to minimize soil losses.

6. Dallam-Rickmore association

Level to undulating, deep fine sandy loam, and sandy

loam and sandy clay loam to a depth of 60 inches or more.

Vingo soils are on hummocky uplands. They are nearly level to undulating. The surface layer is loamy sand, and the subsoil is sandy loam to a depth of more than 60 inches.

The soils of this association are used for grazing cattle and for wildlife habitat. Dallam and Rickmore

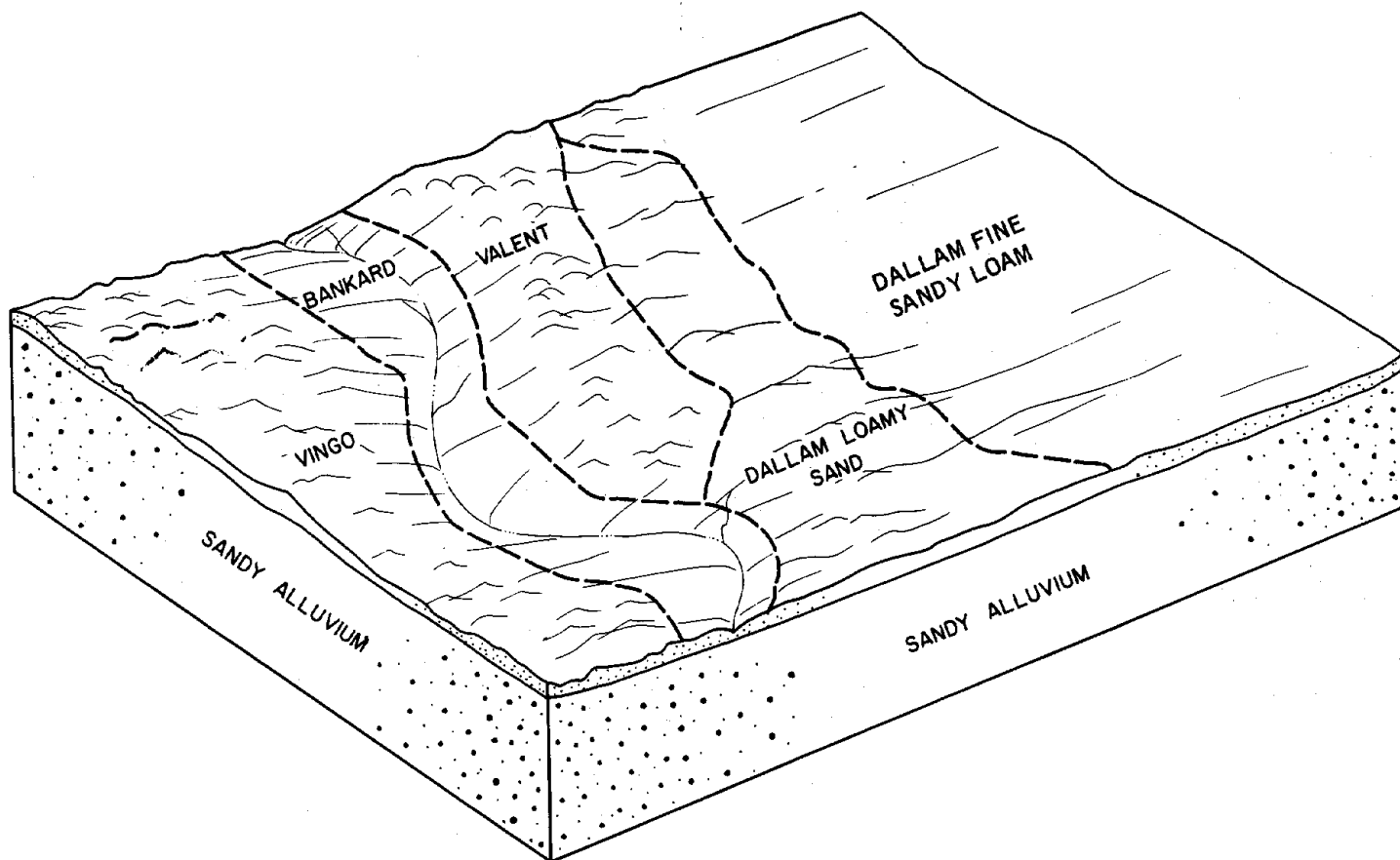


Figure 5.—Typical pattern of the soils in association 6.

This association makes up about 4 percent of the area. It is about 45 percent Manzano soils; 20 percent Alicia soils; 20 percent Kim soils; and 15 percent La

benches. Rock outcrop on basalt capped mesas, escarpments, and mountainsides

This association is in the northwest corner of the

Ustolls are on valley fill. They are steep to very steep. Typically, the surface layer is gravelly, cobbly, or stony loam or clay loam, and the substratum is loam to clay.

ping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (15).

slopes.

The Des Moines soils are on mountainsides and sides of ridges. They are moderately steep to very steep.

Alicia series

TABLE 1.—Approximate acreage and proportionate extent of soils

Soil	Acres	Per- cent	Soil	Acres	Per- cent
Alicia loam, 3 to 9 percent slopes	18,074	0.7	Litle clay loam, 1 to 9 percent slopes	18,414	.8
Apache-Rock outcrop complex	34,343	1.4	Manzano loam	52,581	2.2
Aridic Haplustolls-Rubble land complex	14,108	.6	Plack loam, 0 to 9 percent slopes	49,858	2.0
Ayon-Apache association	116,167	4.8	Raton-Rock outcrop complex	10,143	.4
Bandera association	2,288	.1	Rickmore sandy loam	68,777	2.8
Bankard loamy sand	11,412	.5	Rizozo-Rock outcrop complex	7,919	.3
Capulin loam, 0 to 5 percent slopes	28,239	1.2	Sherm clay loam	50,546	2.1
Capulin-Apache complex	55,956	2.3	Spurlock loamy sand, 1 to 9 percent slopes	39,156	1.6
Carnero loam, 0 to 5 percent slopes	39,702	1.6	Spurlock loam, 1 to 5 percent slopes	132,550	5.4
Carnero-Partri complex	95,415	3.9	Spurlock-Plack complex	81,704	3.3
Colmor silty clay loam, 0 to 5 percent slopes	27,426	1.1	Texline loam, 1 to 5 percent slopes	72,720	3.0
Dalcán-Rock outcrop complex	6,140	.3	Torreón silty clay loam	159,819	6.5
Dallam loamy sand, 0 to 5 percent slopes	46,947	1.9	Travessilla-Rock outcrop complex, 0 to 15 percent slopes	265,815	10.9
Dallam fine sandy loam, 0 to 5 percent slopes	92,700	3.8	Travessilla-Rock outcrop complex, 30 to 75 percent slopes	156,631	6.4
Des Moines-Rock outcrop complex	11,157	.5	Ustolls-Rock outcrop association	32,969	1.4
Dioxice loam, 0 to 5 percent slopes	34,375	1.4	Valent loamy sand, 3 to 9 percent slopes	9,114	.4
Escabosa loam, 3 to 5 percent slopes	36,842	1.5	Vermejo silty clay loam	2,513	.1
Fallsam-Rock outcrop complex	10,369	.4	Vingo-Dallam complex	63,940	2.6
Gruver loam	240,533	9.8	Lakes	189	(¹)
Guy-TeXline complex	46,213	1.9	Pits (Gravel pits, caliche pits, cinder pits)	299	(¹)
Kim sandy loam, 1 to 9 percent slopes	9,037	.4	Playas	8,058	.3
Kim-Manzano association	88,482	3.6			
La Brier silty clay loam	80,491	3.3			
La Brier-Rock outcrop complex	12,749	.5			
			Total	2,442,880	100.0

¹ Less than 0.05 percent.

Cca—32 prismatic structure parting to weak fine subangular blocky; hard when dry, friable when moist, slightly sticky and plastic when wet; common very fine roots; common fine pores; strongly calcareous; moderately alkaline; clear smooth boundary. 15 to 30 inches thick. to 73 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) when moist; weak fine granular structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few very fine roots; common fine pores; few

on alluvial fans in long, narrow or fan-shaped areas of 10 to 160 acres.

Included with this soil in mapping, and making up about 5 percent of the mapped acreage, are Kim soils that are intermingled with the Alicia soils. Also included, and making up about 5 percent, is a soil that is similar to this Alicia soil but that has a clay subsoil; it is in less sloping areas. Also included are Travessilla and Rizozo soils near outcrops of sandstone; together they make up about 5 percent of the mapped acreage.

This soil is used for range and wildlife habitat. Irrigated capability unit IVe-6, nonirrigated capability



Figure 6.—Roadcut, showing Apache cobbly loam underlain by basalt bedrock.

Permeability is moderate. Runoff is medium. Available water capacity is 0.5 to 2.5 inches. Effective rooting depth is 4 to 20 inches. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Apache soils are used for range, wildlife habitat, water supply, and community development.

Representative profile of Apache cobbly loam, from an area of Ayon-Apache association, 720 feet north and 1,664 feet west of the intersection of ranch road and the railroad track, in the NE $\frac{1}{4}$ sec. 24, T. 26 N., R. 34 E:

A1—0 to 8 inches; dark grayish brown (10YR 4/2) cobbly heavy loam, very dark grayish brown (10YR 3/2) when moist; weak medium subangular blocky structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common very fine and few fine pores; strongly calcareous; moderately alkaline; clear smooth boundary. 4 to 9 inches thick.

B2—8 to 12 inches; brown (10YR 5/3) cobbly light clay loam, dark brown (10YR 4/3) when moist; moderate fine subangular blocky structure; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common fine roots; common very fine and few fine pores; strongly calcareous; moderately alkaline; clear boundary. 0 to 5 inches thick.

Cca—12 to 16 inches; mixed white (10YR 8/2) and very pale brown (10YR 8/3) cobbly light clay loam; massive; few fine roots,

few fine pores; strongly calcareous; moderately alkaline; abrupt wavy boundary. 0 to 6 inches thick.

R—16 inches; fractured, hard, carbonate-coated basalt bedrock.

The depth to bedrock is 4 to 20 inches. The soil is 0 to 15 percent gravel and 5 to 25 percent cobbles. The cobbles and gravel combined make up 5 to 35 percent of the soil material.

The A horizon is brown, grayish brown, or dark grayish brown when dry and dark brown or very dark grayish brown when moist. It is loam, clay loam, or cobbly or gravelly loam or clay loam.

The B horizon has the same textural range as the A horizon, and it is brown or grayish brown when dry and brown, dark brown, or dark grayish brown when moist.

Ap—Apache-Rock outcrop complex (1 to 15 percent slopes). Apache cobbly loam, 1 to 15 percent slopes, makes up about 40 percent of this complex; Rock outcrop makes up 25 percent; and Ayon cobbly clay loam, 1 to 9 percent slopes, makes up 15 percent. Included soils make up the remaining 20 percent. Areas are 40 to more than 640 acres in size.

The Apache soil is on the sides of hills and ridges. Rock outcrop is on hilltops, ridgetops, and escarpments. The Ayon soil is between ridges and at the bases of hills.

Included with these soils in mapping, and making up 10 percent of the mapped acreage, are Capulin, La Brier, and Torreon soils. These soils are on broad, flat ridgetops and along drainage channels. Also included in transitional areas between Rock outcrop and Apache soils is a soil that is less than 4 inches deep to bedrock. This included soil makes up about 10 percent of the mapped acreage.

These soils are used for water supply, range, and wildlife habitat. Nonirrigated capability subclass VII₂; Apache cobbly loam in Malpais range site, Rock outcrop not assigned to a range site.

Aridic Haplustolls

In certain types of terrain, separation of soils at the level of phases of soil series was not feasible. In such areas the soils were mapped and named at a category in the soil classification system broader than the series. Aridic Haplustolls, for example, is a subgroup. See the section "Formation and Classification of the Soils" for a more complete explanation of the system.

Aridic Haplustolls are shallow to deep, well drained soils on side slopes and on benches and terraces leading away from basalt-capped mesas. These soils formed in residuum weathered from mixed shale, limestone, and basalt rubble. Slopes are 1 to 45 percent. Elevation is 6,800 to 7,500 feet. Vegetation is mainly oak brush, pinon pine, oneseed juniper, and mixed grama grasses. The average annual precipitation is 17 to 19 inches, and the average annual air temperature is 45° to 50° F. The length of the frost free season is 120 to 160 days.

The surface layer is dark colored loam to clay. On the benches and terraces, the soil is deep and the sub-

ing away from the benches, the soil is underlain by shale, mixed clay and shale, or limestone at a depth of 4 to 25 inches. The soils are noncalcareous to

slightly calcareous; mildly alkaline; clear smooth boundary. 2 to 11 inches thick.
B2—11 to 16 inches: brown (10YR 5/3) very

outcrop and Rubble land. Also included, and making up about 5 percent each, are Torreon and Capulin soils. Rock outcrop is on ledges and ridges, and Rubble land is at the bases of ledges and small hills. Torreon and Capulin soils are in flat areas on uplands.

These soils are used for range, wildlife habitat, water supply, and community development. Nonirrigated capability subclass VII_s; Malpais range site.

Bandera series

The Bandera series consists of deep, somewhat excessively drained soils in areas below volcanic cinder cones. These soils are underlain by a continuous layer of gravel-sized cinders at a depth of 12 to 26 inches. They formed in eolian and colluvial material of volcanic origin. Slopes are 0 to 25 percent. Elevation is 6,900 to 7,900 feet. Vegetation is mainly blue grama, side-oats grama, and big and little bluestem. The average annual precipitation is 16 to 19 inches, and the average annual air temperature is 42° to 45° F. The length of the frost free season is 110 to 120 days.

In a representative profile the surface layer is dark grayish brown gravelly silt loam 12 inches thick. The next layer is grayish brown gravelly sandy loam. Gravel-sized cinders are at a depth of 19 inches. The soil material is neutral to a depth of 12 inches and moderately alkaline below.

Permeability is moderate. Runoff is slow. Available water capacity is 1.5 to 3 inches. Effective rooting depth is 12 to 26 inches. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

These soils are used for range, wildlife habitat, and recreation and as a source of material for railroad ballast and cinder blocks.

Representative profile of Bandera gravelly silt loam in an area of Bandera association, 0.25 mile west and 0.2 mile north of the southeast corner sec. 33, T. 30 N., R. 28 E.:

A1—0 to 12 inches; dark grayish brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; moderate fine granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine and very fine interstitial pores; 35 percent gravel-sized cinders; noncalcareous; neutral; clear smooth boundary. 6 to 14 inches thick.

AC—12 to 19 inches; grayish brown (10YR 5/2) gravelly heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate fine granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many fine and very fine pores; 35 percent gravel-sized cinders; strongly calcareous; moderately alkaline; gradual smooth boundary 0 to

dark brown, very dark brown, or very dark grayish brown when moist. It is gravelly silt loam or gravelly loam.

The AC horizon is grayish brown, dark grayish brown, dark gray, or brown when dry and dark brown or very dark grayish brown when moist. It is gravelly sandy loam or gravelly loam and is 25 to 35 percent cinder gravel. The AC horizon is mildly or moderately alkaline and slightly to strongly calcareous. A discontinuous layer of cemented calcium carbonate is directly below the AC horizon in some areas.

Bd—Bandera association (0 to 25 percent slopes). Bandera gravelly silt loam, 0 to 25 percent slopes, makes up 60 percent of this association; a soil that is similar to this Bandera gravelly silt loam except that it is 4 to 12 inches thick over cinder gravel makes up 15 percent; and Cinder land makes up 15 percent. Included soils make up the remaining 10 percent. Areas are 60 to 400 acres in size.

The Bandera soil is at the bases of volcanic cones on the northern and eastern sides of the cones. It has the profile described as representative of the series. The soil that is similar to the Bandera soil is transitional between the Bandera soil and the cinder land and is interspersed between them in the landscape. Cinder land is on cinder cones; it is very similar to the Bandera soil except that 0 to 4 inches of soil material overlies the cinders. Slopes of the cinder land range from 10 to 80 percent.

Included with these soils in mapping are Apache, Ayon, and Fallsam soils on basalt flows and Capulin and La Brier soils in depressions. The included soils on basalt flows make up about 5 percent of the mapped acreage; those in depressions also make up about 5 percent.

This association is used for range, wildlife habitat, and recreation and as a source of material used for railroad ballast and cinder blocks. Bandera gravelly silt loam in nonirrigated capability subclass VI_e, Cinder land in nonirrigated capability subclass VIII_s; Bandera soils in Cinder range site.

Bankard series

The Bankard series consists of deep, well drained soils on flood plains or stream terraces. These soils are subject to flooding from ephemeral streams. They formed in river-worked alluvium. Slopes are 0 to 3 percent. Elevation is 4,300 to 5,300 feet. Vegetation is mainly sand sagebrush, big bluestem, and blue grama. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 50° to 57° F. The length of the frost free season is 175 to 185 days.

In a representative profile the surface layer is brown loamy sand about 7 inches thick. The substratum to a depth of 77 inches is yellowish brown and light yellowish brown sand with a few thin strata of sandy loam or loam. The soil material is neutral and noncalcareous.

years to twice a year. The hazard of soil blowing on bare soil is severe. The hazard of water erosion is slight.

These soils are used for range and wildlife habitat.

Representative profile of Bankard loamy sand in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 17, T. 28 N., R. 37 E.:

A1—0 to 7 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) when moist; very weak medium subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few coarse and fine roots; many interstitial pores; noncalcareous; neutral; gradual wavy boundary. 3 to 19 inches thick.

C1—7 to 50 inches; yellowish brown (10YR 5/4) sand, brown (10YR 4/3) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; few fine roots; many interstitial pores; 5 percent fine gravel; a few thin strata of sandy loam and loam mostly at depths of 24 to 27 inches; slightly calcareous; mildly alkaline; gradual smooth boundary. 30 to 90 inches thick.

C2—50 to 77 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) when wet; single grained; loose when dry and moist, nonsticky and nonplastic when wet; few very fine roots; many interstitial pores; 10 percent fine gravel; slightly calcareous; mildly alkaline.

The soil is neutral to moderately alkaline. The A horizon is brown or pale brown when dry and brown or dark brown when moist. Texture is loamy sand or sand.

The C horizon is loamy sand or sand with thin strata of sandy loam or loam. Gravel content ranges from 0 to 25 percent; pebbles are fine to medium in size and are water rounded.

Bk—Bankard loamy sand (0 to 3 percent slopes). This soil is in river-worked alluvium on flood plains and stream terraces in long, narrow areas of 40 to 200 acres.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, is a soil that is similar to this Bankard soil but that does not have thin strata of loam or sandy loam. This included soil is in stream channels. Also included in the same landscape position as this Bankard soil are Manzano and Valent soils. These soils each make up about 5 percent of the mapped acreage.

This soil is used for range and wildlife habitat. Non-irrigated capability subclass VIe; Deep Sand range site.

Capulin series

The Capulin series consists of deep, well drained soils on alluvial fans and valley fill around basalt cones and volcanic vents. These soils formed in a mixture of residuum and alluvium weathered from basalt and eolian material. Slopes are 0 to 5 percent. Elevation is 5,000 to 7,000 feet. Vegetation is mainly blue grama, galleta, and side-oats grama. The average

annual precipitation is 14 to 18 inches, and the average annual air temperature is 47° to 53° F. The length of the frost free season is 140 to 180 days.

In a representative profile (fig. 7) the surface layer is dark grayish brown heavy loam about 10 inches thick. The subsoil is grayish brown and brown clay loam 21 inches thick. The substratum to a depth of 41 inches is very pale brown loam. Below this to a depth of 66 inches, it is white cobbly loam. The soil material is slightly calcareous and mildly alkaline to moderately alkaline to a depth of 31 inches and strongly calcareous and moderately alkaline below.

Permeability is moderate. Runoff is medium. Available water capacity is 6 to 9 inches. Effective rooting

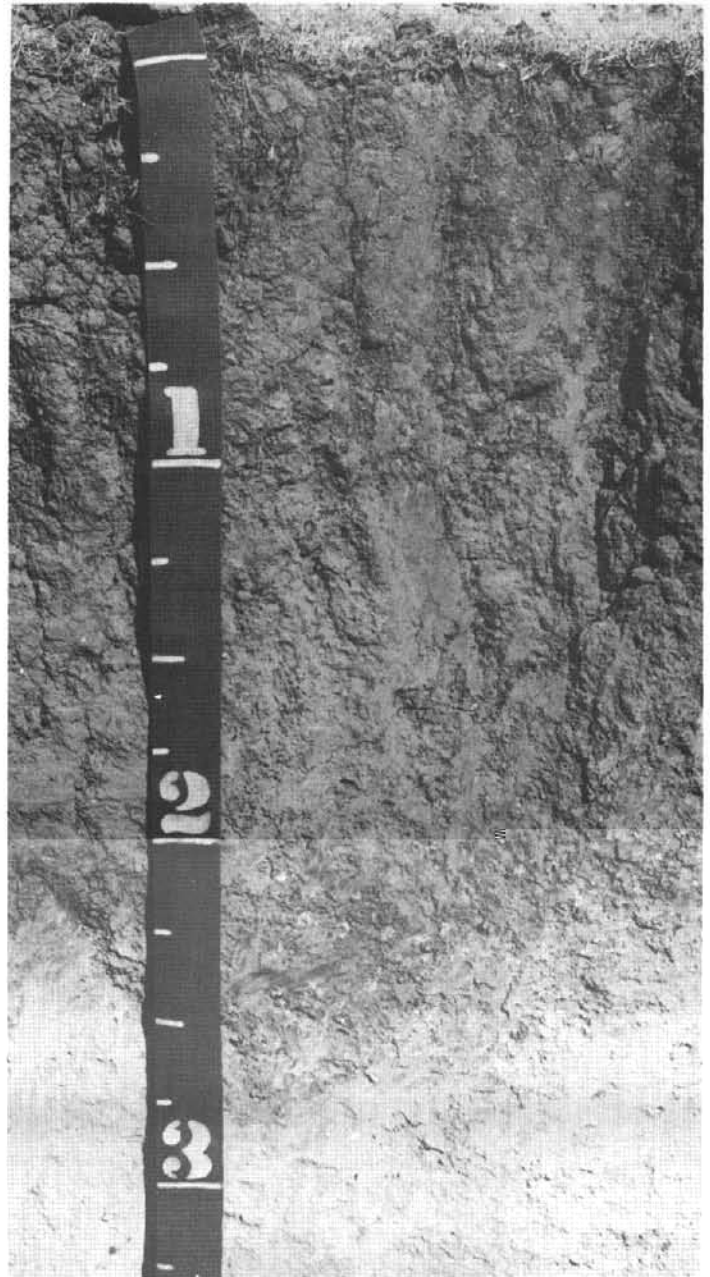


Figure 7.—Profile of Capulin loam, 0 to 5 percent slopes.

depth is 40 to 60 inches. The hazards of soil blowing and water erosion on bare soil are moderate.

These soils are used for range and wildlife habitat.

Representative profile of Capulin loam, from an area of Capulin-Apache complex, 4 miles west of Clayton on U.S. Highway 64; 1,450 feet west and 200 feet north of the southeast corner of sec. 11, T. 26 N., R. 33 E.:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; weak fine granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many very fine pores; many dark mineral grains in the sand- and silt-sized fractions; slightly calcareous; mildly alkaline; abrupt smooth boundary. 3 to 10 inches thick.

A3—3 to 10 inches; dark grayish brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; moderate medium prismatic structure parting to weak fine subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine

friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine and very fine pores; many dark mineral grains in the sand- and silt-sized fractions; 15 percent basalt fragments, mostly pebbles and a few cobblestones; strongly calcareous; lime segregated in concretions and on outside of basalt fragments; moderately alkaline; clear irregular boundary. 6 to 12 inches thick.

C2ca—41 to 66 inches; white (10YR 8/2) cobbly loam, very pale brown (10YR 7/3) when moist; massive; very hard when dry, firm when moist, weakly cemented when wet; many very fine pores; many dark mineral grains in the sand- and silt-sized fractions; 30 percent basalt fragments typically more than 3 inches in diameter; strongly calcareous; moderately alkaline.

The thickness of the solum and the depth of the C1ca horizon is 20 to 40 inches. Basalt bedrock is at a depth of more than 40 inches. Cobblestones or gravel make up 5 to 15 percent of the soil above a depth of 40 inches.

The A horizon is dark grayish brown or brown when

has a profile similar to the one described as representative of its series except that cobbles make up 25

clay loam, dark brown (7.5YR 4/3)
when moist; moderate medium subangu-

52 percent of this complex, and Partri silty clay loam, 0 to 3 percent slopes, makes up 40 percent. Included soils make up the remaining 8 percent. Areas are 160 acres or more.

The Carnero soil is on low ridges and is intermediate between areas of sandstone ridges and ledges and areas of the Partri soil, which is in flatter areas away from exposures of sandstone in most places. The Carnero and Partri soils each have the profile described as representative of their respective series.

Included with these soils in mapping, and making up about 2 percent each of the mapped acreage, are Escabosa and Travessilla soils, slickspots, and Rock outcrop. Escabosa and Travessilla soils and Rock outcrop are on or near sandstone ridges and ledges. Slickspots, areas in which the subsoil is exposed at the surface, are in depressions.

These soils are used for range and wildlife habitat. Irrigated capability unit IIIe-9, nonirrigated capability subclass VIe; Loamy range site.

Colmor series

The Colmor series consists of deep, well drained soils on uplands. These soils formed in mixed eolian material that was deposited over sandstone or shale. Slopes are 0 to 5 percent. Elevation is 5,400 to 7,000 feet. Vegetation is mainly blue grama, galleta, three-awn, and broom snakeweed. The average annual precipitation is 14 to 18 inches and the average annual

ous; moderately alkaline; clear wavy boundary. 6 to 16 inches thick.

B3ca—18 to 30 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many fine roots; many fine pores; few fine insect casts; few fine soft lime masses; strongly calcareous; moderately alkaline; clear wavy boundary. 7 to 14 inches thick.

C1ca—30 to 44 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few fine roots; common fine and very fine pores; few fine threads and soft lime masses; strongly calcareous; moderately alkaline; abrupt wavy boundary. 10 to 20 inches thick.

R—44 inches; sandstone bedrock.

Depth to sandstone or shale bedrock is more than 40 inches. Texture is heavy loam, silt loam, clay loam, or silty clay loam throughout. These soils are moderately to strongly calcareous in the A and B horizons, and higher concentrations of carbonates are in the lower part of the B horizon and in the C horizon.

The A horizon is brown or dark brown when dry



Figure 8.—View of Dalcan-Rock outcrop complex near the top of Sierra Grande.

The soil material is noncalcareous and neutral throughout.

Permeability is slow. Runoff is rapid. Available water capacity is 1.5 to 3 inches. Effective rooting depth is 20 to 40 inches. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Dalcan cobbly silt loam from an area of Dalcan-Rock outcrop complex, in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 30, T. 29 N., R. 29 E.:

A1—0 to 6 inches; dark gray (10YR 4/1) cobbly silt loam, black (10YR 2/1) when moist; moderate medium granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many fine pores; 15 percent angular stones and cobblestones; neutral; clear smooth boundary. 3 to 17 inches thick.

A3—6 to 18 inches; dark grayish brown (10YR 4/2) cobbly silty clay loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many

fine pores; 50 percent angular cobblestones and stones; neutral; clear wavy boundary. 0 to 18 inches thick.

B2t—18 to 31 inches; brown (10YR 5/3) very cobbly clay, dark brown (10YR 3/3) when moist; moderate fine granular structure; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; common fine pores; 70 percent angular cobblestones and stones; neutral; abrupt wavy boundary. 5 to 18 inches thick.

R—31 inches; fractured andesite bedrock.

The depth to bedrock is 20 to 40 inches. The content of rock fragments increases with depth. The profile is mostly noncalcareous, but in places the material directly above or in fractures in the bedrock is slightly calcareous.

The A horizon is silt loam, silty clay loam, loam, or clay loam. It is 10 to 60 percent coarse fragments.

The B2t horizon is pale brown or brown when dry and brown or dark brown when moist. It is clay or silty clay. It is 50 to 90 percent rock fragments.

Da—Dalcan-Rock outcrop complex (9 to 45 percent slopes). Dalcan cobbly silt loam, 9 to 45 percent slopes, makes up about 50 percent of this complex; Rock outcrop makes up 15 percent; and Rubble land makes up

10 percent. The remaining 25 percent is included soils. Areas are more than 640 acres in size and are on Sierra Grande.

Dalcon soils are on the sides and Rock outcrop is on the tops of mountains and ridges. Rubble land is on talus slopes. The Dalcan soil has the profile described as representative of the series.

Included with this complex in mapping, and making up about 15 and 10 percent, respectively, of the mapped acreage, are Raton soils near the top of Sierra Grande and Des Moines soils in less sloping areas.

This complex is used for range, wildlife habitat, and water supply. Nonirrigated capability subclass VII_s; Dalcan cobbly silt loam in Mountain Grassland range site, Rock outcrop not assigned to a range site.

Dallam series

The Dallam series consists of deep, well drained soils on uplands of the High Plains. These soils formed in eolian sediment. Slopes are 0 to 5 percent. Elevation is 4,300 to 6,000 feet. Vegetation is mainly blue grama, side-oats grama, bluestem grasses, small soapweed (yucca), and sand sagebrush. The average annual precipitation is 14 to 17 inches.

heavy sandy clay loam, reddish brown (5YR 4/4) when moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; many fine and very fine roots; few fine and many very fine pores; continuous thin clay films on peds; slightly calcareous; mildly alkaline; gradual wavy boundary. 6 to 20 inches thick.

B23tca—36 to 53 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak medium subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few very fine pores; few thin clay films on peds; few small soft masses and threads of lime; slightly calcareous; mildly alkaline; clear wavy boundary. 12 to 20 inches thick.

B24tca—53 to 72 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish yellow (5YR 6/6) when moist; weak me-

10 percent of the mapped acreage, is a soil that is
similar to this Dellen soil except that it is calcareous

cent gravel, cobblestones, and stones;
neutral; abrupt irregular boundary. 4 to

Dioxice series

The Dioxice series consists of deep, well drained soils on uplands. These soils formed in mixed alluvial and eolian material over old caliche beds. Slopes are 0 to 5 percent. Elevation is 5,000 to 7,000 feet. Vegetation is mainly blue grama, side-oats grama, and buffalo-grass. The average annual precipitation is 15 to 18

strongly calcareous; moderately alkaline.
7 to 26 inches thick.

C2cam—46 inches; fractured indurated caliche.

The solum is 24 to 40 inches thick above the Cca horizon. Depth to indurated caliche is more than 40 inches.

The A1 horizon is grayish brown, brown, or dark brown when dry and very dark grayish brown or dark

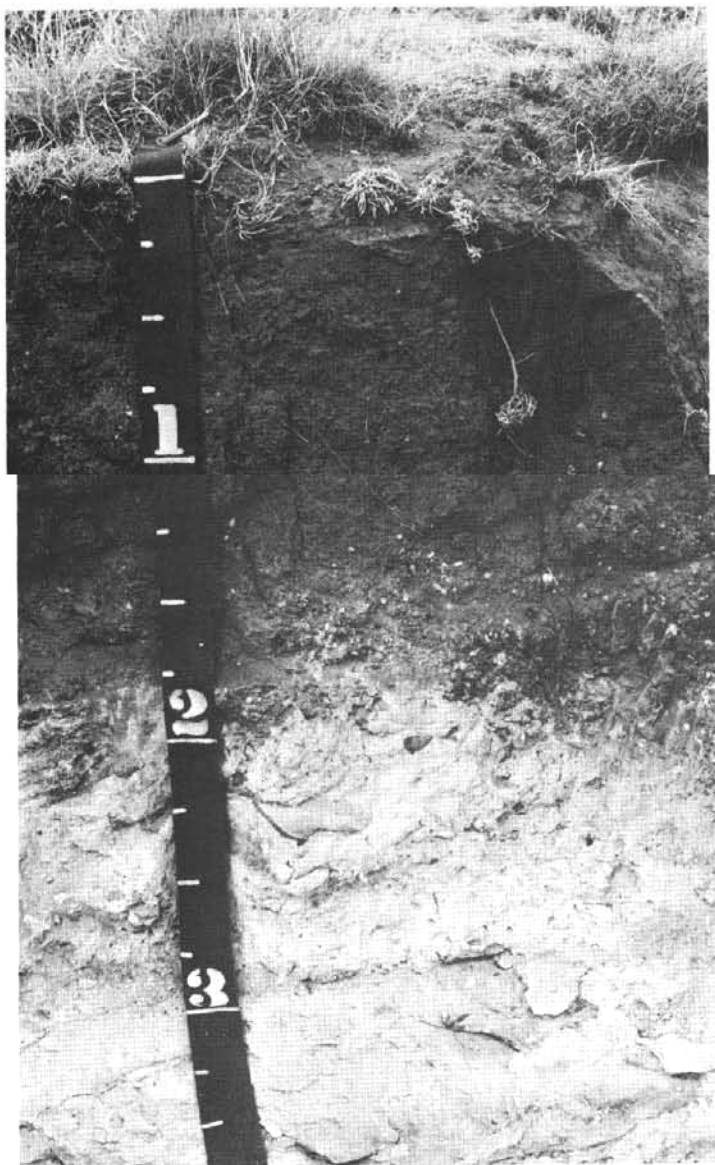


Figure 9.—Profile of Escabosa loam, 3 to 5 percent slopes.

erately alkaline; clear smooth boundary. 5 to 12 inches thick.

B2—8 to 13 inches; brown (10YR 4/3) loam, brown (10YR 4/3) when moist; weak medium subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine and many very fine pores; strongly calcareous; moderately alkaline; clear smooth boundary. 5 to 12 inches thick.

B3ca—13 to 18 inches; brown (10YR 5/3) clay loam, dark yellowish brown (10YR 4/4) when moist; weak medium subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine

roots; few fine and many very fine pores; strongly calcareous; moderately alkaline; abrupt smooth boundary. 3 to 10 inches thick.

Cca—18 to 36 inches; very pale brown (10YR 8/4) gravelly loam, very pale brown (10YR 7/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many fine and very fine pores; 20 percent lime-coated gravel; strongly calcareous; moderately alkaline; abrupt smooth boundary. 7 to 20 inches thick.

R—36 inches; sandstone bedrock.

Depth to bedrock is 20 to 40 inches. Depth to the Cca horizon is 12 to 30 inches.

The A horizon is sandy loam, loam, or clay loam. The B horizon is loam or clay loam and is 0 to 15 percent coarse fragments. The Cca horizon is 5 to 35 percent gravel or cobbles—usually fragments of the underlying bedrock. Bedrock is sandstone in most places but is hard shale or limestone in some places.

EsC—Escabosa loam, 3 to 5 percent slopes. This soil is on rounded hills and uplands in areas of 40 to 400 acres.

Included with this soil in mapping, and making up about 10 percent each of the mapped acreage, are Spurlock and Travessilla soils. Also included, and making up about 5 percent each, are Carnero and Partri soils and Rock outcrop. Spurlock soils are in no regular pattern on the landscape. Travessilla soils and Rock outcrop are along drainage channels and on ridgetops. Partri and Carnero soils are in flatter areas and along old drainage channels. Small areas of Litle, Plack, and Texline soils are also included.

Escabosa soils are used for range and wildlife habitat. Nonirrigated capability subclass VIe; Shallow range site.

Fallsam series

The Fallsam series consists of deep, well drained soils on the sides of basalt squeeze-ups and ridges. These soils formed in residuum weathered from basalt modified by eolian material. Slopes are 1 to 9 percent. Elevation is 6,400 to 7,800 feet. Vegetation is mainly blue grama, side-oats grama, western wheatgrass, blue-stem grasses, skunkbush sumac, and oneseed juniper. The average annual precipitation is 15 to 18 inches, and the average annual air temperature is 45° to 49° F. The length of the frost free season is 120 to 150 days.

In a representative profile the surface layer is about 9 inches thick. It is dark grayish brown cobbly silt loam in the upper part and dark brown cobbly silty clay loam in the lower part. The subsoil to a depth of 38 inches is brown very cobbly clay. To a depth of 46 inches it is brown very cobbly clay loam. The soil material is noncalcareous and neutral throughout.

Permeability is slow. Runoff is medium. Available water capacity is 2 to 5 inches. Effective rooting depth is 40 inches or more. The hazards of soil blowing and water erosion are slight.

These soils are used for range and wildlife habitat. Representative profile of Fallsam cobbly silt loam,

from an area of Fallsam-Rock outcrop complex, 2,600 feet west and 2,450 feet south of the northeast corner of sec. 27, T. 30 N., R. 28 E.:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) cobbly silt loam, very dark grayish brown, (10YR 3/2) when moist; weak

Raton soils, which make up 5 percent. Apache soils are near Rock outcrop, La Brier soils are in small valleys and drainage channels, and Raton soils are on the edges of the basalt flows or on small hills.

This complex is used for range and wildlife habitat.



Figure 10.—Profile of Gruver loam.

B23t—18 to 26 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) when moist; moderate medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; few fine and common very fine pores; mildly alkaline; clear smooth boundary. 6 to 16 inches thick.

B24tca—26 to 43 inches; light brown (7.5YR 6/4) sandy clay loam; brown (7.5YR 4/4) when moist; moderate coarse subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; common fine

and many very fine pores; thin patchy clay films; common threads and soft masses of lime; moderately calcareous; moderately alkaline; clear smooth boundary. 10 to 20 inches thick.

B25tca—43 to 59 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate coarse prismatic structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few very fine roots; common fine and very fine pores; thin patchy clay films; common threads and soft masses of lime; moderately calcareous; moderately alkaline; clear wavy boundary. 0 to 20 inches thick.

B26tca—59 to 74 inches; light brown (7.5YR 6/4) heavy sandy clay loam, yellowish red (5YR 4/6) when moist; weak coarse prismatic structure; slightly hard, friable when moist, slightly sticky and plastic when wet; very few very fine roots; common very fine pores; thin patchy clay films; common threads and soft masses of lime; strongly calcareous; moderately alkaline; clear wavy boundary. 7 to 20 inches thick.

B27t—74 to 80 inches; reddish yellow (5YR 6/6) clay, yellowish red (5YR 4/8) when moist; weak coarse prismatic structure; slightly hard when dry, friable when moist, sticky and plastic when wet; no roots; few very fine pores; slightly calcareous; moderately alkaline.

The solum is more than 60 inches thick in most places. The A horizon is brown or grayish brown when dry and dark brown or very dark grayish brown when moist. It is fine sandy loam, loam, or clay loam and it is neutral or mildly alkaline.

The upper few inches of the B21t horizon typically have the same colors as the A horizon. Below this, the B2t horizon is light brown, reddish yellow, or brown when dry and dark yellowish brown, brown, or yellowish red when moist. Texture of the upper part of the B2t horizon is heavy clay loam and is 35 to 40 percent clay. The lower part of the B2t horizon is clay loam or sandy clay loam. The B2t horizon is dominantly mildly or moderately alkaline. Calcium carbonate equivalent in the B24tca horizon ranges from 5 to 20 percent. Calcium carbonate equivalent in the B25tca horizon is 15 to 30 percent.

Gr—Gruver loam (0 to 3 percent slopes). This soil is in areas of 10 to 400 acres on uplands. Slopes are 0 to 3 percent.

Included with this soil in mapping are Dallam soils on low hills and ridges and La Brier and Sherm soils in depressions and along water channels. These soils each make up 5 percent of the mapped acreage. Also included, and making up about 10 percent, is a soil that is similar to this Gruver loam but in which the upper part of the subsoil is light clay loam.

This soil is used for range, irrigated and nonirrigated crops, and wildlife habitat. Irrigated capability unit IIIe-8, Nonirrigated capability unit IIIe-2; Loamy range site.

Guy series

The Guy series consists of deep, well drained soils on gravelly hills. These soils formed in eroded High Plains sediment derived mainly from the Ogallala Formation. Slopes are 1 to 9 percent. Elevation is 4,300 to 5,800 feet. Vegetation is mainly blue grama, sand dropseed, three-awn, small soapweed (*yucca*), and broom snakeweed. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 49° to 55° F. The length of the frost free season is 160 to 180 days.

In a representative profile (fig. 11) the surface layer is dark grayish brown and grayish brown gravelly loam about 15 inches thick. The substratum is white gravelly sandy loam to a depth of 24 inches, pale brown sandy loam to a depth of 40 inches, and pale brown gravelly loamy sand to a depth of 60 inches or more. The soil material is moderately alkaline and calcareous throughout. Lime is concentrated in the upper part of the substratum.

Permeability is moderately rapid. Runoff is medium. Available water capacity is 3 to 6 inches. Effective rooting depth is 60 inches or more. The hazards of soil blowing and water erosion are moderate.

These soils are used for range and wildlife habitat.

Representative profile of Guy gravelly loam from an area of Guy-Texline complex, 0.05 mile north and 0.05 mile west of the SE corner of sec. 34, T. 28 N., R. 33 E.:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak and moderate medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine and very fine pores; 15 percent gravel with 30 percent of the surface covered with gravel; moderately calcareous; moderately alkaline; abrupt smooth boundary. 5 to 12 inches thick.

A12—7 to 15 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak and moderate medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine and very fine pores; 30 percent gravel; common hard lime masses; strongly calcareous; moderately alkaline; clear wavy boundary. 5 to 10 inches thick.

C1ca—15 to 24 inches; white (10YR 8/2) gravelly sandy loam, very pale brown (10YR 7/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine and common very fine pores; 40 percent gravel; strongly calcareous; moderately alkaline; abrupt wavy boundary. 8 to 24 inches thick.

C2—24 to 40 inches; pale brown (10YR 6/3) heavy sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine and very fine pores; 10 percent gravel; strongly calcareous; moderately alkaline; clear wavy boundary. 0 to 20 inches thick.

C3—40 to 60 inches; very pale brown (10YR 7/3) gravelly loamy sand, pale brown (10YR 6/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; many fine pores; 35 percent gravel; strongly calcareous; moderately alkaline.

Guy soils have a veneer of water-worn gravel, cobblestones, and a few stones covering about 10 to 40 percent of the surface in most places. Depth to the C1ca horizon is 10 to 20 inches. Texture between depths of 10 and 40 inches averages sandy loam with 10 to 35 percent gravel.

The A horizon is brown, dark grayish brown, or grayish brown when dry and dark brown, very dark brown, or very dark grayish brown when moist. It is sandy loam or loam and is 5 to 40 percent gravel.

The Cca horizon is light gray or white when dry and light brownish gray or very pale brown when moist. It is gravelly loam, gravelly sandy loam, sandy loam, or gravelly loamy sand. The calcium

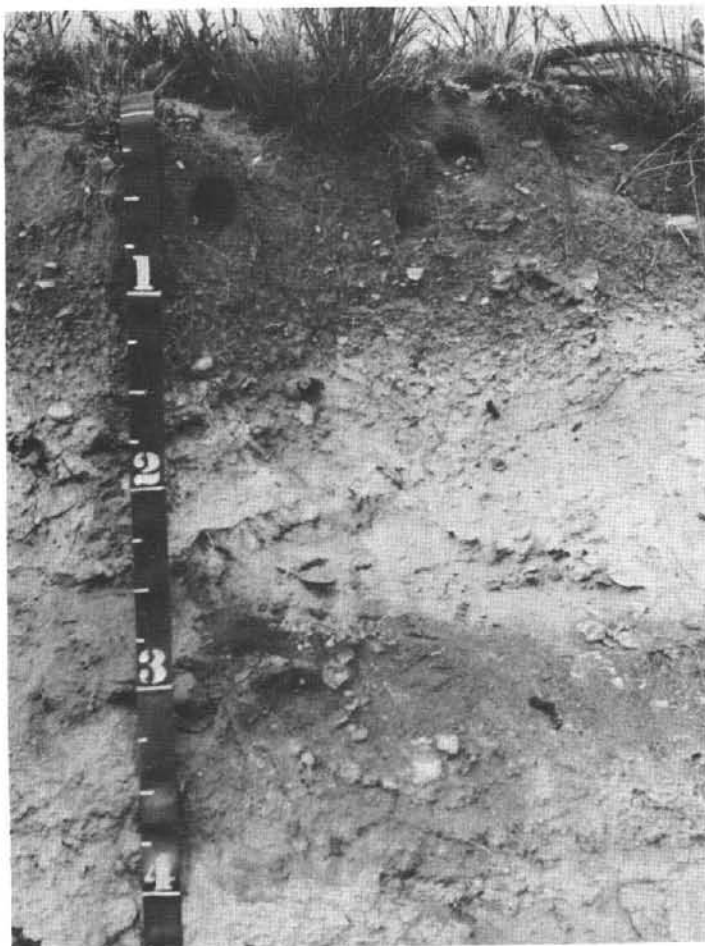


Figure 11.—Profile of Guy gravelly loam in an area of the Guy-Texline complex.

carbonate equivalent of the Cca horizon ranges from 15 to 40 percent.

Gt—Guy-Textline complex (1 to 9 percent slopes). Guy gravelly loam, 1 to 9 percent slopes, makes up about 50 percent of this complex, and Textline loam, 1 to 5 percent slopes, makes up 30 percent. Included soils make up the remaining 20 percent. Most areas are larger than 300 acres.

The Guy soil is on low gravelly hills and ridges. The Textline soil is on alluvial fans in valleys between ridges and hills. The Guy soil has the profile described as representative of its series, and the Textline soil has a profile similar to the one described as representative of its series.

Included with these soils in mapping, and making up about 10 percent of the mapped acreage, are soils that are similar to this Textline soil except that they have a sandy loam subsoil. They are on alluvial fans. Also included, and making up about 10 percent, are Dallam and Spurlock soils on low hills and ridges.

These soils are used for range and wildlife habitat. Nonirrigated capability subclass VIe; Guy soil in Shallow range site, Textline soil in Loamy range site.

Kim series

The Kim series consists of deep, well drained soils on foot slopes and alluvial fans. These soils formed in mixed deposits of alluvium. Slopes are 1 to 9 percent. Elevation is 4,400 to 6,400 feet. Vegetation is mainly blue grama, side-oats grama, galleta, three-awn, sand dropseed, small soapweed (yucca), and cholla. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 49° to 57° F. The length of the frost free season is 140 to 185 days.

In a representative profile (fig. 12) the surface layer is brown loam about 8 inches thick. The substratum is brown and light brown clay loam to a depth of 60 inches. The soil material is slightly calcareous in the upper 8 inches and strongly calcareous below. It is mildly alkaline to a depth of 13 inches and moderately alkaline below.

Permeability is moderate. Runoff is medium. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. The hazards of water erosion and soil blowing are moderate.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Kim loam from an area of Kim-Manzano association, SE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 23, T. 29 N., R. 33 E.:

A1—0 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak fine granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; few fine and very fine pores; slightly calcareous; mildly alkaline; clear smooth boundary. 6 to 12 inches thick.

C1—8 to 13 inches; brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 4/4) when moist; weak medium subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and

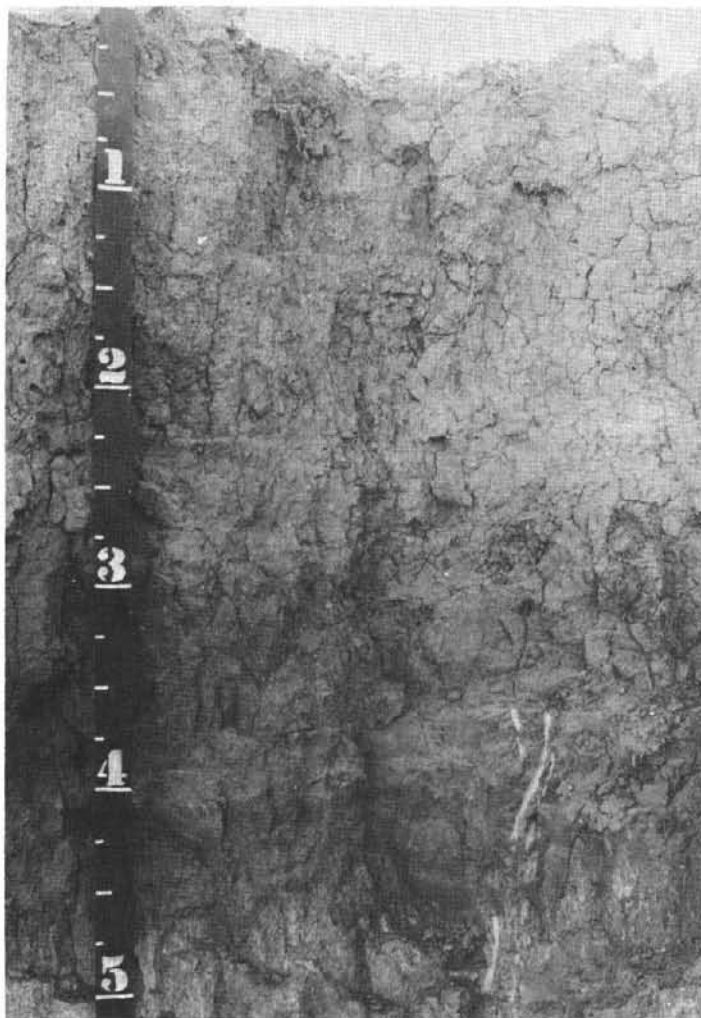


Figure 12.—Profile of Kim loam in an area of the Kim-Manzano association.

slightly plastic when wet; many fine and very fine roots; few fine and common very fine pores; strongly calcareous; mildly alkaline; abrupt smooth boundary. 4 to 20 inches thick.

C2—13 to 28 inches; light brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; weak medium subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; few fine and common very fine pores; 5 percent fine soft lime masses; strongly calcareous; moderately alkaline; abrupt wavy boundary. 8 to 16 inches thick.

C3—28 to 60 inches; light brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine and very fine roots; few fine and many very

fine pores; few thin lime filaments; strongly calcareous; moderately alkaline.

Gravel makes up 0 to 5 percent of this profile. Reaction is mildly alkaline to moderately alkaline throughout the profile.

The A1 horizon is grayish brown or brown when dry and brown, dark brown, or dark grayish brown when moist. It is sandy loam to heavy loam.

The C horizon is light gray, gray, light brown, pale brown, or brown when dry and brown, light grayish brown, grayish brown, or dark brown when moist. It is loam, clay loam, or sandy clay loam. Calcium carbonate masses make up 0 to 15 percent, by volume, of the C horizon.

KaD—Kim sandy loam, 1 to 9 percent slopes. This soil is on uplands surrounding playa lakes in areas of 40 to 300 acres. This soil has a profile that is similar to the one described as representative of the series except that the surface layer is sandy loam and the soil is more olive throughout.

Included with this soil in mapping are Colmor, Dioxide, and Spurlock soils in no regular pattern. These soils make up, respectively, about 10, 5, and 5 percent of the mapped acreage. Also included, and making up about 1 percent each, are Vermejo and Little soils around the playa lakes.

These soils are used for range, wildlife habitat, and water supply. Nonirrigated capability subclass VIe; Sandy range site.

Km—Kim-Manzano association (0 to 9 percent slopes). Kim loam, 3 to 9 percent slopes, makes up about 60 percent of this association, and Manzano loam, 0 to 3 percent slopes, makes up about 20 percent. Included soils make up the remaining 20 percent.

Areas are long and narrow and 60 to 300 acres in size in most places.

The Kim soil is on alluvial fans leading to stream channels. The Manzano soil is along stream channels on flood plains. The Kim and Manzano soils each have the profile described as representative of their respective series.

Included with these soils in mapping are Texline soils on alluvial fans and Gruver soils in depressions. These soils make up, respectively, about 10 and 5 percent of the mapped acreage. Also included, and making up about 5 percent, are Carnero, La Brier, and Travesilla soils.

These soils are used for range, wildlife habitat, and water supply. A few small areas are used for irrigated crops. Kim loam in irrigated capability unit IVE-6, nonirrigated capability unit IVE-2; Manzano loam in irrigated capability unit IIE-6, nonirrigated capability unit IVE-2; Loamy range site.

La Brier series

The La Brier series consists of deep, well drained soils in concave swales in valley fill and on valley bottoms. These soils formed in alluvium weathered from mixed sources. Slopes are 0 to 3 percent. Elevation is 4,500 to 7,000 feet. The vegetation is mainly blue grama, western wheatgrass, alkali sacaton, and galleta. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 47°

to 57° F. The length of the frost free season is 140 to 180 days.

In a representative profile (fig. 13) the surface layer is very dark grayish brown silty clay loam about 13 inches thick. The subsoil is grayish brown clay and heavy silty clay loam 36 inches thick. The substratum is grayish brown silty clay loam to a depth of 77 inches. The soil material is noncalcareous in the upper 13 inches and calcareous below. Lime content increases with depth. The soil material is moderately alkaline throughout.

Permeability is very slow. Runoff is medium. Available water capacity is 8.5 to 10 inches. Effective rooting depth is more than 60 inches. The hazards of soil blowing and water erosion are moderate.



Figure 13.—Profile of La Brier silty clay loam in an area of the La Brier-Rock outcrop complex.

These soils are used for range, irrigated and non-irrigated crops, and wildlife habitat.

Representative profile of La Brier silty clay loam, 1,500 feet north and 315 feet west of the SE corner of sec. 7, T. 26 N., R. 36 E.:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few very fine pores; moderately alkaline; clear smooth boundary. 0 to 9 inches thick.

A3—9 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak medium prismatic structure parting to moderate, fine, subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common very fine pores; moderately alkaline; clear smooth boundary. 4 to 13 inches thick.

B21t—13 to 22 inches; grayish brown (10YR 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak medium prismatic structure parting to moderate, medium and fine, subangular blocky; hard when dry, firm when moist, sticky and slightly plastic when wet; common very fine roots; common very fine pores; many thin clay films on prism surfaces; slightly calcareous; moderately alkaline; clear smooth boundary. 5 to 12 inches thick.

B22t—22 to 34 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; weak medium prismatic structure parting to moderate, medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; few very fine roots; few very fine pores; thin continuous clay films; slightly calcareous; moderately alkaline; gradual smooth boundary. 5 to 15 inches thick.

B3tca—34 to 49 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; weak medium subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common very fine pores; few thin clay films; moderately calcareous, lime is in few fine threads and few medium soft masses; moderately alkaline; gradual smooth boundary. 10 to 15 inches thick.

Cca—49 to 77 inches; grayish brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; massive; very hard when dry, firm when moist, slightly sticky and slightly plastic

when wet; many very fine pores; strongly calcareous, lime is in irregularly shaped soft masses; moderately alkaline.

The solum is 30 to 60 inches thick. The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown when dry and dark brown, very dark brown, or very dark grayish brown when moist. It is silty clay loam or clay loam and is neutral to moderately alkaline.

The Bt horizon is light brownish gray, grayish brown, brown, or pale brown when dry and is very dark grayish brown, dark grayish brown, brown, or yellowish brown when moist. It is silty clay loam, heavy clay loam, or clay, and clay content averages from 35 to 60 percent. The Bt horizon is noncalcareous or slightly calcareous in the upper part, and slightly or moderately calcareous in the lower part. It is mildly or moderately alkaline.

The C horizon has chroma of 4 or less to a depth of 80 inches. There is no horizon of strong lime accumulation within 60 inches of the surface. Bedrock is deeper than 60 inches in most places, but in a few places bedrock is at a depth of 40 to 60 inches.

La—La Brier silty clay loam (0 to 3 percent slopes). This soil is in small valleys and on low areas of valley fill in areas of 100 to more than 640 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping, and making up 5 percent each of the mapped acreage, are Sherm and Manzano soils. Also included, and making up less than 1 percent, are Vermejo and Gruver soils. None of these included soils is in a regular pattern on the landscape.

This soil is used for range, irrigated crops and non-irrigated crops, and wildlife habitat. Irrigated capability unit IIs-1, nonirrigated capability unit IVe-1; Clayey range site.

Lr—La Brier-Rock outcrop complex (0 to 9 percent slopes). La Brier silty clay loam, 0 to 3 percent slopes, makes up about 40 percent of this complex; Fallsam cobbly silty clay loam, 1 to 9 percent slopes, makes up 30 percent; and Rock outcrop makes up 15 percent. The remaining 15 percent is included soils. This complex is on broad lava flows in areas of more than 300 acres (fig. 14).

The La Brier soil is in small valleys between basalt ridges and squeeze-ups, and the Fallsam soil is on the sides and Rock outcrop is on the tops of the ridges and squeeze-ups. The La Brier soil has a profile similar to the one described as representative of its series except that basalt cobblestones and stones are below a depth of 40 inches and the surface is covered with basalt cobblestones in some places. The Fallsam soil has a profile similar to the one described as representative of its series.

Included with this complex in mapping, and making up about 5 percent each of the mapped acreage, are Torreon soils, Raton soils near the Fallsam soils, and Apache soils on sides of ridges.

This complex is used for range and wildlife habitat. Nonirrigated capability subclass VIs; La Brier silty clay loam in Clayey range site, Rock outcrop not assigned to a range site.

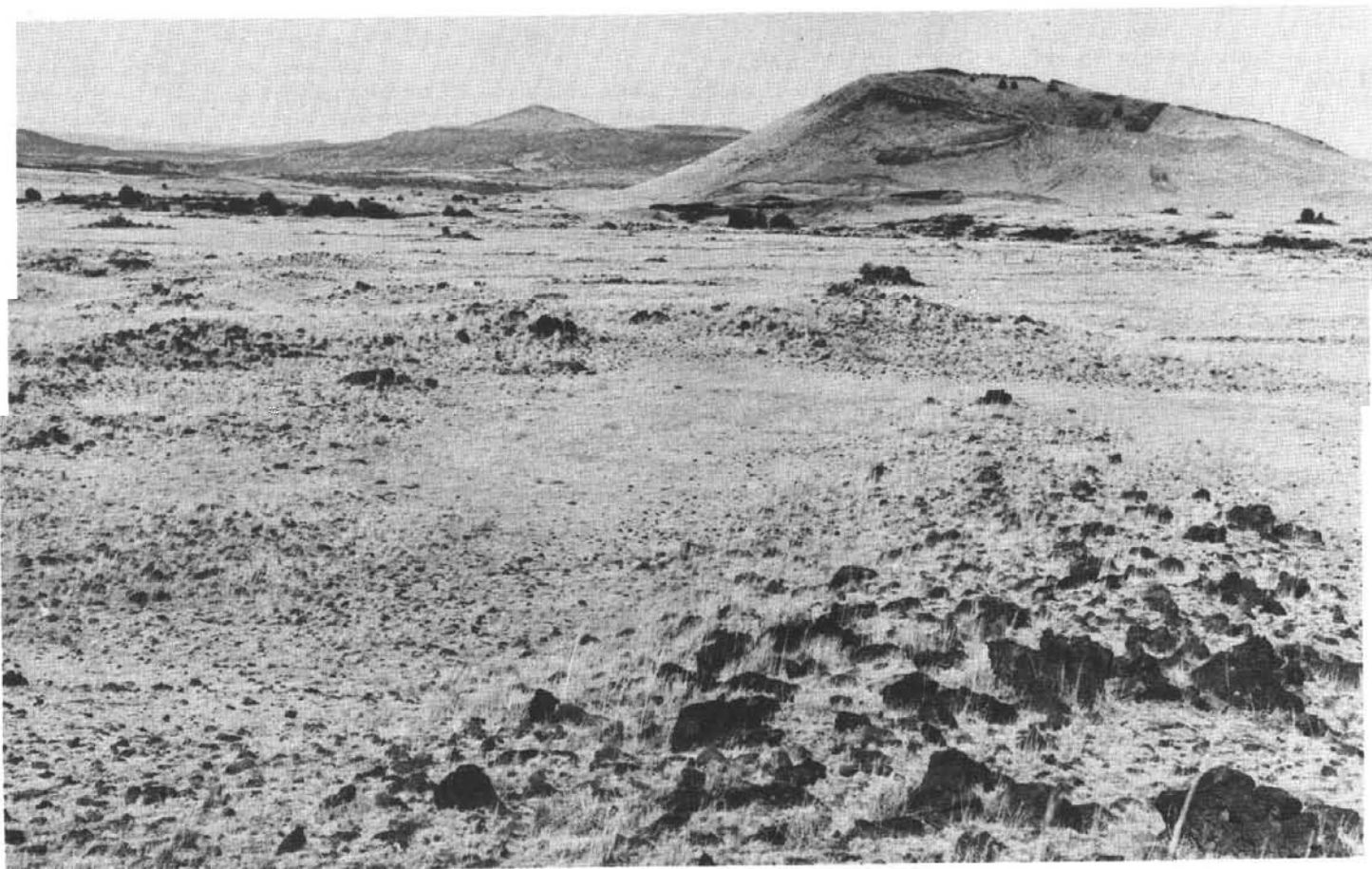


Figure 14.—Landscape of La Brier-Rock outcrop complex.

Litle series

The Litle series consists of well drained soils that are moderately deep to soft shale. These soils are on uplands. They formed in calcareous residuum weathered from shale. Slopes are 1 to 9 percent. Elevation is 5,000 to 6,500 feet. Vegetation is mainly blue grama, side-oats grama, three-awn, small soapweed (yucca), and scattered oneseed juniper. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 50° to 54° F. The length of the frost free season is 140 to 180 days.

In a representative profile the surface layer is brown heavy clay loam about 10 inches thick. The subsoil is pale brown heavy silty clay loam 12 inches thick. Soft shale is at a depth of 22 inches. The soil material is slightly calcareous in the upper 10 inches and strongly calcareous below. It is moderately alkaline throughout.

Permeability is slow in the solum and very slow in the underlying shale. Runoff is medium or rapid. Available water capacity is 3 to 5 inches. Effective rooting depth is 20 to 30 inches. The hazard of water erosion is severe, and the hazard of soil blowing is slight.

These soils are used for range and wildlife habitat.

Representative profile of Litle clay loam, 1 to 9 percent slopes, SE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 4, T. 22 N., R. 30 E.:

A1—0 to 10 inches; brown (10YR 5/3) heavy

clay loam, dark brown (10YR 4/3) when moist; moderate fine subangular blocky structure; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; many fine roots; few very fine pores; slightly calcareous; moderately alkaline; clear smooth boundary. 5 to 15 inches thick.

B2—10 to 22 inches; pale brown (10YR 6/3) heavy silty clay loam, dark brown (10YR 4/3) when moist; weak fine subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine roots; few fine and very fine pores; strongly calcareous; moderately alkaline; clear smooth boundary. 6 to 15 inches thick.

Cr—22 to 60 inches; variegated soft shale with lime coatings in fractures.

The solum is 18 to 24 inches thick. Depth to shale is 20 to 30 inches.

The A1 horizon is brown, light olive brown, or pale brown when dry and dark brown, brown, or olive brown when moist. It is clay or clay loam and mildly alkaline or moderately alkaline.

The B2 horizon is pale brown, brown, light olive brown, or yellowish brown when dry and brown, dark

brown, or olive brown when moist. It is silty clay loam or clay. Content of gypsum or salts in the B and C horizons ranges from none to moderate.

In places a B3 or C1 horizon is between the B2 and

loam, dark brown (10YR 3/3) when moist; weak medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic

clay and very pale brown clay. Sandstone bedrock is at a depth of 48 inches. The soil material is neutral in the upper 14 inches, mildly alkaline in the next 16 inches, and moderately alkaline below.

grayish brown when moist. It is loam, silt loam, silty clay loam, or clay loam.

The B21t horizon has the same colors as the A horizon. The B22t horizon is brown or reddish brown.

and Spurlock soils. These included soils are in depressions or level areas.

This soil is used for range and wildlife habitat. Nonirrigated capability subclass VII_s; Shallow range site.

Raton series

The Raton series consists of shallow, well drained soils on the sides of basalt ridges. These soils formed in residuum weathered from basalt. Slopes are 3 to 15 percent. Elevation is 6,600 to 7,600 feet. Vegetation is mainly blue grama, western wheatgrass, fringed sagebrush, and oak brush. The average annual precipitation is 15 to 18 inches, and the average annual air temperature is 42° to 45° F. The length of the frost free season is 100 to 120 days.

In a representative profile the surface layer is dark gray cobbly heavy silt loam about 9 inches thick. The subsoil is dark brown very cobbly clay 9 inches thick. Basalt bedrock is at a depth of 18 inches. The soil material is noncalcareous and neutral throughout.

Permeability is slow. Runoff is rapid. Available water capacity is 0.5 to 1 inch. Effective rooting depth is 8 to 20 inches. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Raton cobbly silt loam from an area of Raton-Rock outcrop complex, 1,200 feet north and 500 feet west of the southeast corner of sec. 8, T. 31 N., R. 28 E.:

A1—0 to 9 inches; dark gray (10YR 4/1) cobbly heavy silt loam, very dark gray (10YR 3/1) when moist; strong fine granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few very fine pores; 60 percent basalt boulders on surface; about 15 percent basalt cobblestones; neutral; abrupt irregular boundary. 6 to 12 inches thick.

B2t—9 to 18 inches; dark brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) when moist; strong very fine subangular blocky and angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many fine roots; common very fine pores; common thin clay films; 50 percent basalt cobblestones; neutral. 2 to 10 inches thick.

R—18 inches; basalt bedrock.

Depth to bedrock and thickness of the solum are 8 to 20 inches. Cobblestones or stones cover 40 to 70 percent of the surface.

The A horizon is dark gray or dark grayish brown when dry and very dark gray, very dark grayish brown, or very dark brown when moist. It is silt loam or silty clay loam and is 15 to 70 percent cobblestones, stones, or boulders.

The B2t horizon is brown, dark brown, or dark grayish brown when dry and dark brown or very dark grayish brown when moist. It is mostly displaced bedrock that has soil and clay films in its fractures. Coarse

fragments make up 50 to 70 percent of the B2t horizon.

Ra—Raton-Rock outcrop complex (3 to 15 percent slopes). Raton cobbly silt loam, 3 to 15 percent slopes, makes up about 60 percent of this complex, and Rock outcrop makes up 20 percent. Included soils make up the remaining 20 percent. Areas are 100 to 500 acres in size.

The Raton soil is on the sides and Rock outcrop is on the tops of basalt ridges (fig. 15).

Included with this complex in mapping, and making up about 10 and 5 percent, respectively, of the mapped acreage, are Dalcan and Des Moines soils. Also included, and making up 5 percent, are undifferentiated soils and land types. The inclusions follow no definite pattern.

This complex is used for range, wildlife habitat, and water supply. Nonirrigated capability subclass VII_s; Raton cobbly silt loam in Malpais range site, Rock outcrop not assigned to a range site.

Rickmore series

The Rickmore series consists of deep, well drained



Figure 15.—Landscape of Raton-Rock outcrop complex.

soils on uplands. These soils formed in mixed alluvium weathered from High Plains sedimentary formations. Slopes are 0 to 3 percent. Elevation is 4,500 to 6,500 feet. Vegetation is mainly blue grama, hairy grama, and little bluestem. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 50° to 57° F. The length of the frost-free season is 160 to 185 days.

In a representative profile the surface layer is brown loamy sand and sandy loam about 13 inches thick. The subsoil extends to a depth of 93 inches or more. It is brown, light brown, pink, and reddish

very fine pores; common thin clay films on peds; slightly calcareous; mildly alkaline; gradual smooth boundary. 0 to 20 inches thick.

B23tca—34 to 43 inches; pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) when moist; moderate coarse subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; many very fine pores; few thin clay films on peds; strongly calcareous; moderately alkaline; gradual smooth

soils. These soils are along the Cimarron River. They formed in residuum weathered from sandstone. Slopes are 0 to 9 percent. Elevation is 4,500 to 5,000 feet. Vegetation is mainly blue grama, side-oats grama, small soapweed (yucca), and scattered oneseed juniper. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 49° to 57° F. The length of the frost free season is 160 to 180 days.

In a representative profile the soil is yellowish red loam and red channery silt loam about 10 inches thick

Rock outcrop

Rock outcrop consists of exposures of bare rock in areas that range from nearly level to vertical. Elevation is 4,300 to 8,700 feet. In many areas the only vegetation is lichens, but some areas support brush and trees in fractures. The average annual precipitation, the average annual air temperature, and the length of the frost free season are determined by the soils with which Rock outcrop is mapped.

Where Travessilla or Rizo soils are near Rock out-

Permeability is very slow. Runoff is medium. Available water capacity is 8.5 to 10 inches. Effective rooting depth is more than 60 inches. The hazards of soil blowing and water erosion are moderate.

These soils are used for range and wildlife habitat. Representative profile of Sherm clay loam, in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 36, T. 26 N., R. 35 E.:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate very fine subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many fine and very fine roots; many fine pores; neutral; clear smooth boundary. 2 to 9

when moist, sticky and plastic when wet; few very fine pores; strongly calcareous; moderately alkaline.

The A1 horizon is brown, dark grayish brown, and grayish brown when dry and dark brown or very dark grayish brown when moist. It is heavy loam or clay loam and neutral to mildly alkaline.

The B1t horizon is heavy clay loam or clay and has the same colors as the A horizon. The upper part of the B2t horizon is dark grayish brown, grayish brown, or brown when dry and brown, dark brown, or dark grayish brown when moist. It is clay, and clay content ranges from 40 to 55 percent. Structure is strong or moderate, medium, angular or subangular blocky. Texture of the lower part of the B2t horizon ranges from

careous; mildly alkaline; clear smooth boundary. 4 to 14 inches thick.

B2—6 to 16 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; weak medium subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few fine and very fine roots; common very fine pores; very strongly calcareous; mildly alkaline; clear wavy boundary. 0 to 14 inches thick.

C1ca—16 to 28 inches; white (10YR 8/2) clay loam, pale brown (10YR 6/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine pores; very strongly calcareous; moderately alkaline; clear abrupt boundary. 6 to 20 inches thick.

C2ca—28 to 40 inches; pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few very fine pores; very strongly calcareous; moderately alkaline; clear wavy

irrigated capability subclass VIe; Deep Sand range site.

SrC—Spurlock loam, 1 to 5 percent slopes. This soil is on uplands in areas of 40 to more than 300 acres. It has the profile described as representative of the series.

Included with this soil in mapping are Dioxice soils, Kim soils near drainage channels, Dallam soils in flatter areas, and Plack soils on ridgetops. Dioxice soils have no definite pattern of occurrence. They make up about 10 percent of the mapped acreage, and Kim, Dallam, and Plack soils each make up about 5 percent. Also included in this unit, and making up only about 1 percent of the mapped acreage, are Travessilla soils.

Runoff is medium on this Spurlock soil. The hazards of water erosion and soil blowing are moderate.

These soils are used mostly for range and wildlife habitat, but a few areas are used for irrigated crops. Irrigated capability unit IIIe-12; nonirrigated capability subclass VIe; Sandy range site.

Su—Spurlock-Plack complex (0 to 9 percent slopes). Spurlock loam, 1 to 5 percent slopes, makes up 60 percent of this complex, and Plack loam, 0 to 9 percent slopes, makes up 20 percent. Included soils make up

calcareous below. It is mildly alkaline in the upper 5 inches and moderately alkaline below.

Permeability is moderate. Runoff is medium. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. The hazards of water erosion and soil blowing are moderate.

These soils are used for range and wildlife habitat.

Representative profile of Texline loam, 1 to 5 percent slopes, in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 20, T. 29 N., R. 31 E.:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; weak fine subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; many fine and very fine roots; few very fine pores; mildly alkaline; clear smooth boundary. 5 to 16 inches thick.

B21t—5 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate medium subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; few medium and common fine and very fine roots; few fine and common very fine pores; thin patchy clay films on peds; slightly calcareous below a depth of 10 inches; moderately alkaline; gradual smooth boundary. 7 to 15 inches thick.

B22tca—16 to 33 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; moderate medium subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few medium, fine, and very fine roots; common very fine pores; thin patchy clay films on peds; common white soft masses of lime; strongly calcareous; moderately alkaline; gradual smooth boundary. 8 to 18 inches thick.

when moist; weak medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few very fine pores; common white soft masses of lime; strongly calcareous; moderately alkaline.

The solum is more than 60 inches thick. The A horizon is calcareous or noncalcareous. It is brown, dark grayish brown, or grayish brown when dry and dark brown, very dark grayish brown, or very dark brown when moist. It is fine sandy loam, loam, or clay loam.

The B21t horizon has the same colors as the A horizon. The remaining part of the B2t horizon is pale brown, light brown, pinkish gray, or reddish yellow when dry and brown, strong brown, or yellowish red when moist. The part of the B2t horizon below the B21t horizon is loam, sandy clay loam, silty clay loam, or clay loam.

TeC—Texline loam, 1 to 5 percent slopes. This soil is in valley fill along the bases of steep escarpments in long, narrow areas of 40 to 400 acres.

Included with this soil in mapping, and making up 5 percent each of the mapped acreage, are Dallam, Gruver, Kim, and Manzano soils. These included soils are in no definite pattern in the landscape, and changes from one kind of soil to another are gradual.

This mapping unit is used for range and wildlife habitat. Irrigated capability unit IIIe-6, nonirrigated capability unit IVe-1; Loamy range site.

Torreón series

The Torreón series consists of deep, well drained soils on broad, basalt-capped uplands. These soils formed in alluvium weathered from basalt modified by eolian material. Slopes are 0 to 3 percent. Elevation is 5,000 to 7,000 feet. Vegetation is mainly blue grama, western wheatgrass, galleta, fringed sagebrush, and woolly indianweed. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 47° to 53° F. The length of the frost free season is 140 to 175 days.

ture; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; common fine roots; few very

up 10 percent of the mapped acreage; La Brier soils, which make up 5 percent; soils that are similar to this Torreon silty clay loam except that they have rock at a depth of 30 to 40 inches, which make up 5 percent.

stone bedrock. Cobblestones make up 0 to 10 percent of the soil, and gravel makes up 0 to 35 percent. Total rock fragments make up 0 to 35 percent of the soil.

The A1 horizon is light brown, brown, or light brownish gray when dry and brown, dark grayish brown, or grayish brown when moist. It is loamy sand to sandy loam or loam, noncalcareous or slightly calcareous, and mildly alkaline.

The C horizon is sandy loam, loam, or light sandy clay loam; mildly or moderately alkaline; and slightly or moderately calcareous. Thin, discontinuous accumulations of calcium carbonate are immediately above the bedrock, and there are thin coatings on the bedrock in places.

TrE—Travessilla-Rock outcrop complex, 0 to 15 percent slopes. Travessilla sandy loam, 0 to 15 percent slopes, makes up about 70 percent of this complex, and Rock outcrop makes up 20 percent. Included soils make up the remaining 10 percent. Areas are 40 to more than 640 acres in size.

The Travessilla soil borders canyons on uplands. Rock outcrop also borders canyons but is on the edges of steplike terraces or is on eroded hills. The Traves-

silla soil has the profile described as representative of the series.

Included with this complex in mapping are Carnero and Escabosa soils in depressions. These soils make up about 10 percent of the mapped areas. Also included are minor acreages of Little, Plack, and Rizozo soils.

This complex is used for range and wildlife habitat. Nonirrigated capability subclass VII_s; Travessilla sandy loam in Shallow Sandstone range site, Rock outcrop not assigned to a range site.

TrF—Travessilla-Rock outcrop complex, 30 to 75 percent slopes. Travessilla stony sandy loam, 30 to 75 percent slopes, makes up about 40 percent of this complex, and Rock outcrop makes up 30 percent. Included soils make up the remaining 30 percent. Areas are 200 to more than 2,000 acres in size.

This complex is on the sandstone breaks or escarpments leading from the uplands down to the river valleys (fig. 16). The Travessilla soil is on the sides of the escarpments, and Rock outcrop is on the upper edges and on the sides. The Travessilla soil has a profile similar to the one described as representative of the series except that cobblestones and stones cover 5 to 40 percent of the surface.

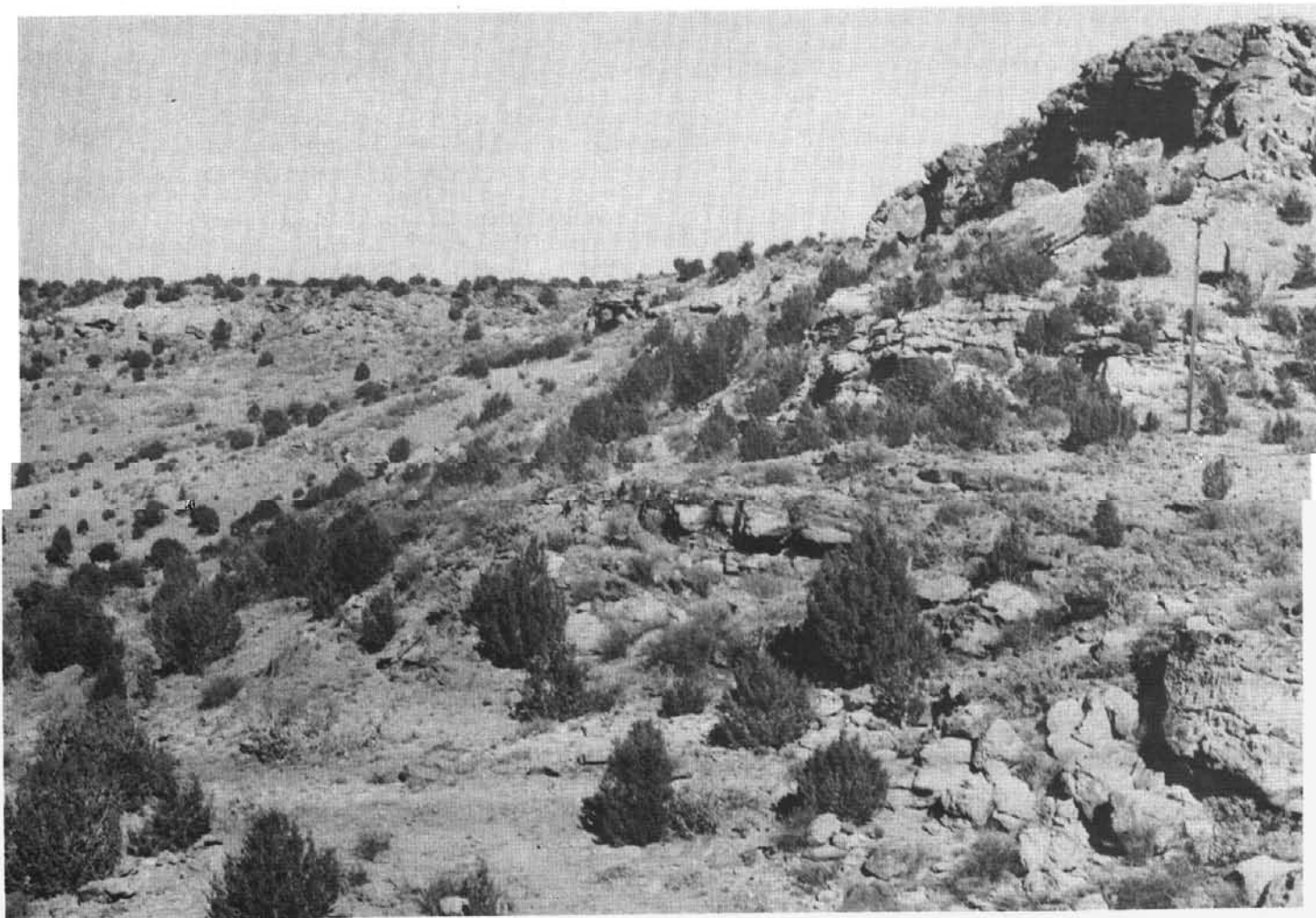


Figure 16.—Landscape of Travessilla-Rock outcrop complex, 30 to 75 percent slopes.

Included with this complex in mapping are Rubble land, which makes up 10 percent of the mapped acreage; Aridic Haplustolls, which make up 5 percent; Litle soils, which make up 5 percent; and Alicia, Kim, Manzano, and Texline soils, which make up 5 percent. Rubble land, Aridic Haplustolls, and Litle soils are in the same areas as Travessilla soils. The Alicia, Kim, Manzano, and Texline soils are at the bottoms of escarpments or in narrow valleys between escarpments.

This complex is used for range, wildlife habitat, and water supply. Nonirrigated capability subclass VII_s; Travessilla stony sandy loam in Breaks range site, Rock outcrop not assigned to a range site.

Ustolls

In certain types of terrain, separation of soils at the level of phases of soil series was not feasible. In such areas the soils were mapped and named in a category in the soil classification system broader than the series. Ustolls, for example, is a suborder. See the section "Formation and Classification of the Soils" for a more complete explanation of the system.

Ustolls are shallow to deep well-drained soils. They

Travessilla soils and Rubble land. Travessilla soils are in sandstone areas over which basalt flowed. Rubble land is immediately below the Rock outcrop.

This association is used for range, wildlife habitat, and water supply. Ustolls in nonirrigated capability subclass VII_s, Rock outcrop in nonirrigated capability subclass VIII_s; Ustolls in Breaks range site, Rock outcrop not assigned to a range site.

Valent series

The Valent series consists of deep, excessively drained soils on sand dunes and hummocky upland plains. These soils formed in eolian sand. Slopes are 3 to 9 percent. Elevation is 4,300 to 6,200 feet. Vegetation is mainly blue grama, hairy grama, side-oats grama, bluestem, sand dropseed, skunkbush sumac, sand sagebrush, and small soapweed (yucca). The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 50° to 57° F. The length of the frost free season is 160 to 185 days.

In a representative profile the surface layer is brown loamy sand about 5 inches thick. The substratum is brown and pink sand to a depth of 94 inches or more. The soil material is homogeneous throughout. Re-

and brown, pale brown, dark brown, or light brown when moist.

VaD—Valent loamy sand, 3 to 9 percent slopes. This soil is in narrow areas of dunes. Areas are 20 to 200 acres in size.

Included with this soil in mapping, and making up 15 percent of the mapped acreage, are Vingo soils in nearly level areas of the landscape or in depressions.

This soil is used for range and wildlife habitat. Non-irrigated capability subclass. V1c; Dune Sand range

calcareous; strongly alkaline; gradual wavy boundary. 8 to 22 inches thick.

C3—46 to 66 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; few very fine pores; strongly calcareous; strongly alkaline.

Shale is below a depth of 40 inches. The soil is

moist; very weak medium subangular inated by the Ogallala Formation. These soils each
blocky structure: soft when drv. very fri- make up about 5 percent of the mapped acreage.

Range condition is the present state of the vegetation or plant community on a range site as related to the climax plant community for the site. The primary purpose in determining range condition is to provide an index of changes that have taken place in the plant cover. When the potential plant community for a site is known, the present range condition can be determined. As a result, a basis is provided for predicting the nature and direction of plant community changes to be expected under a specified program of management.

When changes that occur in the climax plant community are caused by particular kinds of use by livestock or by other disturbance, plants of certain species increase, while plants of other species decrease. Reaction of the plants to grazing depends on the kind of animal grazed, the season of use, and the extent of plant tissue removal. By comparing the composition of the present plant community to that of the climax plant community, it is possible to predict the direction of change.

Permeability is moderately rapid to very slow in soils of this site. Runoff is rapid.

About 80 percent of the vegetation on this site is grasses, 5 percent is shrubs, and 15 percent is pinon pine and juniper trees. Forbs are present, but they are sparsely scattered.

The composition, by weight, of the climax vegetation, or potential plant community, is about 20 percent little bluestem, 20 percent side-oats grama, 20 percent blue and hairy grama, 10 percent western wheatgrass, 10 percent pinon pine, 5 percent galleta, 5 percent needleandthread, 5 percent skunkbush sumac, and 5 percent oneseed juniper. Associated species are black grama, big bluestem, oak brush, mountainmahogany, three-awn, and fringed sagebrush. Where this site is heavily and continually grazed by cattle, little bluestem, side-oats grama, and western wheatgrass are replaced by blue and hairy grama, oak brush, pinon

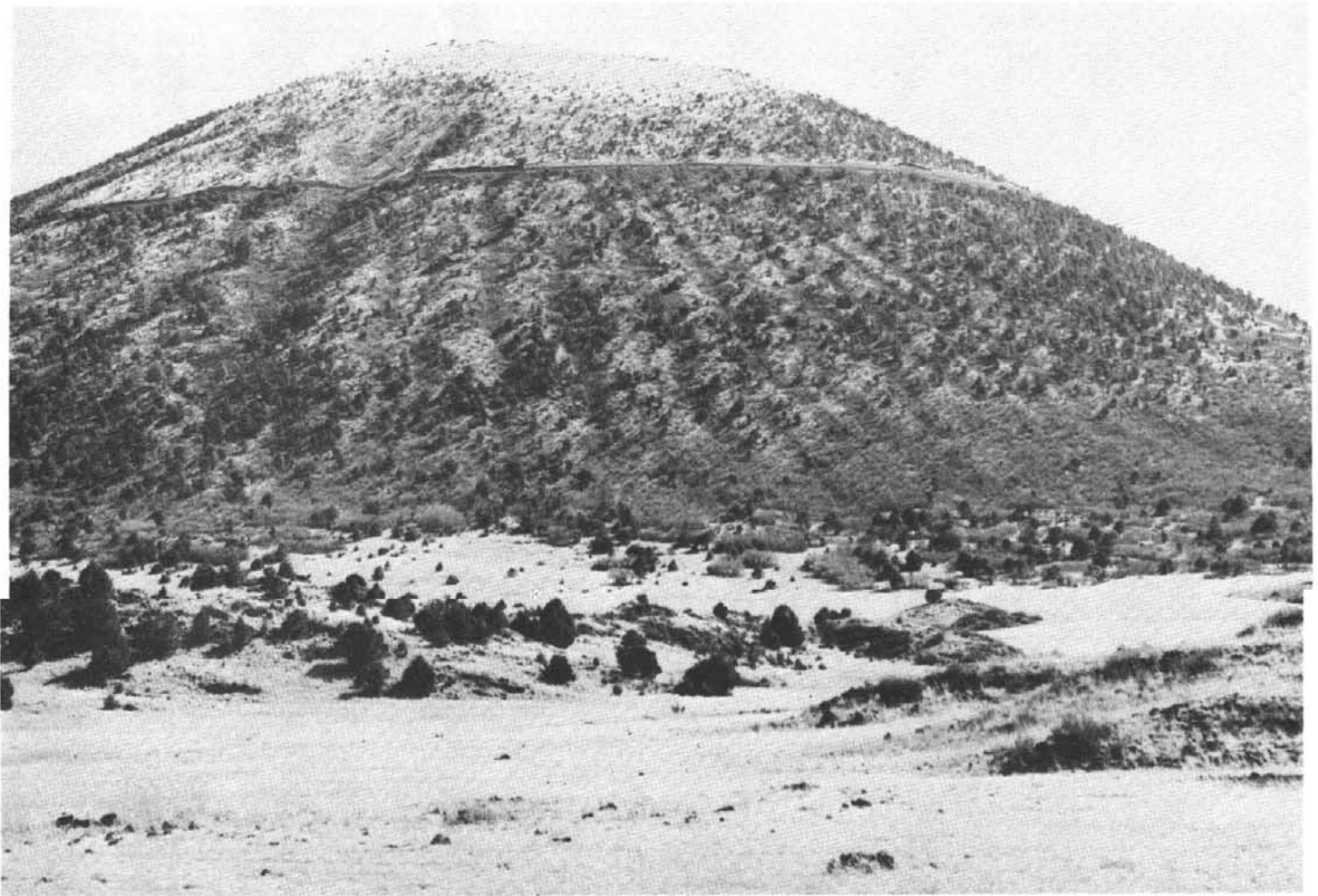


Figure 17.—An area of Cinder range site on Capulin Mountain National Monument. The soil is in the Bandera association. The steeper soil near the upper part of the mountain is not in a range site, but it is suited to wildlife use.

CLAYEY RANGE SITE

This range site (fig. 18) consists of moderately well drained or well drained soils that have a surface layer of clay loam or silty clay loam. Slopes range from 0 to 9 percent.

Permeability is moderately slow to very slow in soils of this site. Runoff is slow to rapid.

About 90 to 95 percent of the vegetation on this site is mid and short grasses, and 5 percent is shrubs. Few or no forbs are present.

The composition, by weight, of the climax vegetation, or potential plant community, is about 25 percent blue grama, 20 percent western wheatgrass, 15 percent galleta, 10 percent vine mesquite, 10 percent side-oats grama, 5 percent buffalograss, 5 percent mat muhly, 5 percent three-awn, and 5 percent four-wing saltbush. Associated species are cactus, ring muhly, and broom snakeweed. Where this site is heavily and continually grazed by cattle, western wheatgrass, vine mesquite, and side-oats grama, are replaced by blue grama, galleta, buffalograss, cactus, and four-wing saltbush. Gumweed, western ragweed, and tumblegrass invade this site in places.

The soils in this site are suited to range seeding,

brush management, contour furrowing, and pitting where improvement of range condition is needed.

If this site is in excellent condition, the total yield of all vegetation ranges from 1,200 pounds per acre in favorable years to 400 pounds in unfavorable years. Approximately 95 percent of this yield is from plants that furnish forage for cattle.

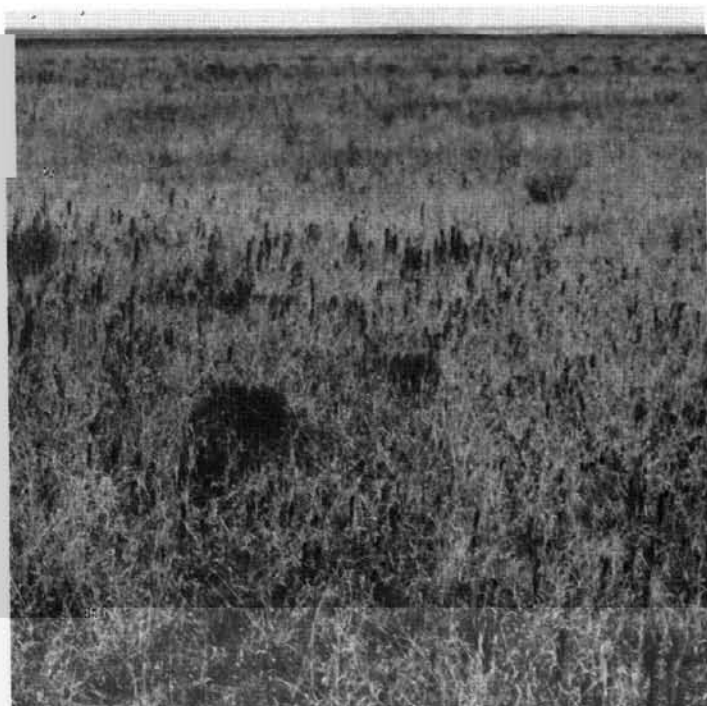
DEEP SAND RANGE SITE

This range site consists of excessively drained or well drained soils that have a surface layer of loamy sand. Slopes range from 0 to 9 percent.

Permeability is moderate to very rapid in soils of this range site. Runoff is slow or very slow.

About 90 percent of the vegetation on this site is grass and 10 percent is yucca. Only a few forbs are present.

The composition, by weight, of the climax vegetation, or potential community, is about 30 percent little bluestem, 15 percent blue and hairy grama, 15 percent sand bluestem, 10 percent side-oats grama, 10 percent sand dropseed, 5 percent New Mexico feathergrass, 5 percent sand sagebrush, 5 percent silver bluestem, and 5 percent small soapweed (yucca). Asso-



Vegetation on this range site is almost entirely pure grass. Only a few forbs or woody species are present.

The composition, by weight, of the climax vegetation, or plant community, is about 40 percent blue grama, 15 percent western wheatgrass, 10 percent side-oats grama, 5 percent vine mesquite, 5 percent sand dropseed, 10 percent buffalograss, 10 percent galleta, and 5 percent three-awn. Associated species are fringed sagebrush, wolftail, gumweed, small soapweed (yucca), broom snakeweed, and ring muhly. Where this site is heavily and continually grazed by cattle, side-oats grama, vine-mesquite, and western wheatgrass are replaced by blue grama, buffalograss, galleta, and ring muhly. Cactus and annuals invade this site in places.

The soils in this site are suited to range seeding, brush management, contour furrowing, and pitting where improvement of range condition is needed. If this site is in excellent condition, the total yield of all vegetation ranges from 1,300 pounds per acre in favorable years to 600 pounds in unfavorable years. Approximately 95 percent of this yield is from plants that furnish forage for cattle.

MALPAIS RANGE SITE

This range site (fig. 19) consists of well drained, cobbly soils that have a surface layer of loam silt

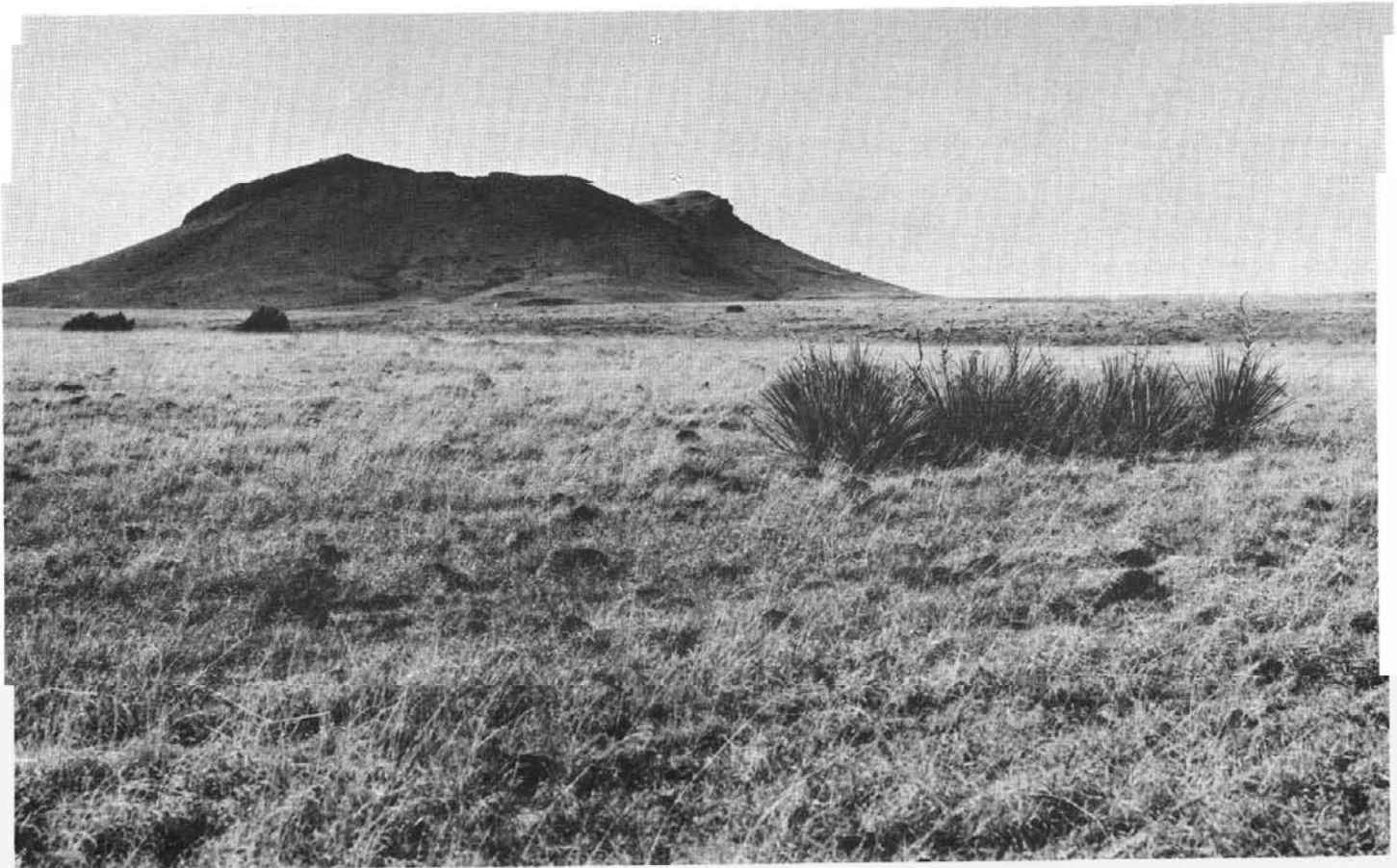


Figure 19.—An area of Malpais range site. The soils are in the Ayon-Apache association and the Apache-Rock outcrop complex.

cent western wheatgrass, 5 percent junegrass, 5 percent mountain brome, 5 percent muttongrass, 5 percent pine dropseed, 5 percent oak brush, 5 percent ponderosa pine, and 5 percent pinon pine. Associated species are side-oats grama, Arizona fescue, mountain-mahogany, sedges, oneseed juniper, and oatgrass. Where this site is heavily and continually grazed by cattle, little bluestem, junegrass, mountain brome, mountain muhly, muttongrass, oatgrass, and pine dropseed are replaced by blue grama, oak brush, oneseed juniper, pinon pine, and ponderosa pine. Kentucky bluegrass, timothy, and redtop invade this site in places.

Designed trails and access roads are commonly needed to provide distribution of livestock.

If this site is in excellent condition, the total annual yield of all vegetation ranges from 1,500 pounds in favorable years to 700 pounds in unfavorable years. About 85 percent of this yield is from plants that furnish forage for cattle.

SANDY RANGE SITE

This range site consists of well drained soils that have a surface layer of fine sandy loam, sandy loam, or loam. Slopes range mostly from 0 to 5 percent, but in a few areas they range up to 9 percent.

Permeability is moderate or moderately slow in soils of this site. Runoff is slow or medium.

The vegetation on this site is predominantly a mix-

ture of grasses. Only a few forbs and scattered small soapweed (yucca) are present.

The composition, by weight, of the climax vegetation, or potential plant community, is about 35 percent side-oats grama, 25 percent blue and hairy grama, 15 percent little bluestem, 10 percent New Mexico feathergrass, 5 percent sand dropseed, 5 percent three-awn, and 5 percent small soapweed (yucca). Associated species are galleta, sand bluestem, sand sagebrush, winterfat, and needleandthread. Where this site is heavily and continually grazed by cattle, side-oats grama, little bluestem, and needlegrasses are replaced by blue grama, hairy grama, three-awn, and small soapweed (yucca). Pricklypear and cholla invade this site in places.

The soils in this site are suited to range seeding and brush management where improvement of the range condition is needed. Special consideration, however, must be made to control soil blowing during revegetation.

If this site is in excellent condition, the total annual yield of all vegetation ranges from 1,300 pounds per acre in favorable years to 800 pounds in unfavorable years. About 90 percent of the yield is from plants that furnish forage for cattle.

SHALLOW RANGE SITE

This range site consists of well drained soils that have a surface layer of gravelly loam or loam. The

soils are shallow over indurated caliche or are moderately deep or deep over bedrock. Slopes range from 0 to 9 percent.

Permeability is moderately rapid or moderate in soils of this site. Runoff is medium.

The vegetation on this site is mostly grasses. A few forbs and woody plants are present.

The composition, by weight, of the climax vegetation, or potential plant community, is about 30 percent blue and hairy grama, 25 percent side-oats grama, 25 percent little bluestem, 5 percent needleandthread, 5 percent New Mexico feathergrass, 5 percent three-awn, and 5 percent wolftail. Associated species are skunk-bush sumac, big bluestem, broom snakeweed, western wheatgrass, and small soapweed (yucca). Where this site is heavily and continually grazed by cattle, little bluestem, needlegrasses, and side-oats grama are replaced by blue grama, hairy grama, three-awn, and

Common name	Scientific name
alkali sacaton	<i>sporobolus airoides</i>
Apacheplume	<i>fallugia paradoxa</i>
Arizona fescue	<i>festuca arizonica</i>
big bluestem	<i>andropogon gerardi</i>
black grama	<i>bouteloua eriopoda</i>
blue grama	<i>bouteloua gracilis</i>
broom snakeweed	<i>gutierrezia sarothrae</i>
buffalograss	<i>buchloe dactyloides</i>
cactus	<i>opuntia</i> spp.
cholla	<i>opuntia</i> spp.
cocklebur	<i>xanthium</i> spp.
fourwing saltbush	<i>atriplex canescens</i>
fringed sagebrush	<i>artemisia frigida</i>
galleta	<i>hilaria jamesii</i>
gumweed	<i>grindelia squarrosa</i>
hairy grama	<i>bouteloua hirsuta</i>
indiangrass	<i>sorghastrum nutans</i>
junegrass	<i>koeleria cristata</i>
Kentucky bluegrass	<i>poa pratensis</i>
little bluestem	<i>andropogon scoparius</i>
littleleaf sumac	<i>rhus microphylla</i>

take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of the soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, windbreaks, or engineering.

In the capability system the kinds of soils are grouped at three levels: the capability class, subclass, and unit.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

restrict their use largely to pasture, range, woodland, wildlife habitat, or recreational areas.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIs-1 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The following management practices apply and shifted from field to field in the field.

to 18 inches, and the length of the frost free season is 140 to 185 days.

Permeability is moderate in soils of this unit. Run-off is moderate. The amount of water erosion and soil deeper soils it is as much as 9 inches. Effective rooting depth is 20 to 40 inches in most areas, but in some it is 40 inches or more.

These soils are not cultivated. Crops need to be

IRRIGATED CAPABILITY UNIT IV-6

This capability unit consists of well drained soils that have a surface layer of loam or silty clay loam and an underlying layer of silty clay loam or clay loam. Slopes are dominantly 3 to 5 percent, but they range from 0 to 9 percent. The average annual precipitation is 14 to 18 inches, and the frost free season is 140 to 185 days.

Permeability is moderate or moderately slow in these soils. Runoff is medium. The hazards of water

severe, and the hazard of soil blowing is slight. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 inches or more.

This soil is used mostly for range and wildlife habitat and is not used for crops. It is suited to pasture and to alfalfa or corn. This soil is better suited to surface irrigation than to other types of irrigation. Drainage is difficult because of the clay, underlying shale, very slow permeability, and low position of the soil in the landscape. It is important to plow this soil

TABLE 2.—*Estimated average yields per acre of principal irrigated crops under a high level of management*

[Only the soils used to a significant extent for any of the specified crops are listed. Absence of figure indicates crop is not suited to that soil or is not commonly grown in it]

Soils	Corn silage	Grain sorghum	Alfalfa hay	Corn	Pasture ¹
	Tons	Lb	Tons	Bu	AUM ²
Alicia loam, 3 to 9 percent slopes -----	^a 18	5,500	5.5	100	11
Capulin loam, 0 to 5 percent slopes -----	20	7,000	6.5	120	13
Carnero-Partri complex -----		4,500	5.0	90	10
Colmor silty clay loam, 0 to 5 percent slopes -----	18	5,700	6.0	120	12
Dallam loamy sand, 0 to 5 percent slopes -----	^a 18	5,500	6.0	105	12
Dallam fine sandy loam, 0 to 5 percent slopes -----	20	6,700	6.5	120	13
Dioxice loam, 0 to 5 percent slopes -----	^a 17	4,500	5.5	95	11
Capulin loam -----	22	7,500	6.0	130	12

NONIRRIGATED CAPABILITY UNIT III-2

The soils in this capability unit are well drained. The surface layer is loam or clay loam, and the subsoil is sandy clay loam, clay, silty clay loam, or clay loam. The slopes of these soils are 0 to 3 percent. The average annual precipitation is 14 to 18 inches, and the frost free season is 140 to 185 days.

Permeability is moderately slow in these soils. Runoff is medium. The hazards of water erosion and soil blowing are moderate. Available water capacity is 7.5 to 10 inches. Effective rooting depth is 60 inches or more.

The principal crop is grain sorghum. These soils are well suited to permanent pasture.

High residue or soil improving crops need to be grown in a cropping sequence with other crops and shifted from field to field in such a way that all of the cropland will be covered at least two-thirds of the time. High residue or soil improving crops also help to reduce the hazard of soil blowing. Plowing needs to be at a right angle to the slope to prevent erosion. All established waterways need a permanent cover of grass. Terraces are needed to reduce the hazard of water erosion on slopes of more than 1 percent.

NONIRRIGATED CAPABILITY UNIT III-3

High residue or soil improving crops need to be grown in a cropping sequence with other crops and shifted from field to field in such a way that all of the cropland will be covered at least three-fourths of the time. High residue or soil improving crops help to reduce the hazard of soil blowing. Plowing needs to be at right angles to the slope, and all waterways need a cover of permanent grass to prevent erosion. Terraces to reduce the hazard of water erosion are needed where slopes are more than 1 percent. To protect against soil blowing, it is necessary to leave clods on the surface. This can be done by plowing deep enough to bring fragments of the subsoil to the surface. Plant residues need to be used to protect cultivated fields.

NONIRRIGATED CAPABILITY UNIT IV-2

The soils in this capability unit are well drained. The surface layer is silty clay loam or loam, and the subsoil or underlying material is clay loam or silty clay loam. Slopes are 0 to 5 percent. The average annual precipitation is 14 to 18 inches, and the frost free season is 140 to 185 days.

Permeability is moderate or moderately slow in these soils. Runoff is medium. The hazards of water erosion and soil blowing are moderate. Available water

shifted from field to field in a way that all of the cropland will be covered at least three-fourths of the time. To protect against soil blowing, it is necessary to leave clods on the surface by plowing deep enough to bring fragments of the subsoil to the surface. High residue or soil improving crops are needed to reduce the hazard of soil blowing.

Estimated Yields of Nonirrigated Crops

The estimates of yields given in table 3 are averages that can be expected over a period of years. These estimates are based on results of research and on information obtained from interviews with land users and other knowledgeable persons. Soils suited to use as range only are not listed in the table.

The yields in table 3 are given for a high level of management, and it was assumed that the following conditions exist:

Soil blowing is controlled by proper use of crop

TABLE 3.—*Estimated average yields per acre of nonirrigated sorghum under a high level of management*

Soils	Pounds per acre
Capulin loam, 0 to 5 percent slopes -----	1,500
Colmor silty clay loam, 0 to 5 percent slopes -----	1,500
Dallam loamy sand, 0 to 5 percent slopes -----	1,600
Dallam fine sandy loam, 0 to 5 percent slopes -----	1,700
Dioxice loam, 0 to 5 percent slopes -----	1,600
Gruver loam -----	1,500
Kim loam (part of Kim-Manzano association) -----	1,500
La Brier silty clay loam -----	1,400
Manzano loam (alone or as part of Kim-Manzano association) -----	1,900
Rickmore sandy loam -----	1,700
Sherm clay loam -----	1,400
Texline loam, 1 to 5 percent slopes -----	1,500
Torreón silty clay loam -----	1,400

TABLE 4.—*Ratings of soils*

Mapping unit and group	Oriental arborvitae			Rocky Mountain juniper		
	Height	Survival	Vigor	Height	Survival	Vigor
	<i>Ft</i>	<i>Pct</i>		<i>Ft</i>	<i>Pct</i>	
Group 1: AcD, CaC, Ch (Capulin part), Cp (Partri part), CrC, DhC, DmC, DxC, Gr, Gt (Texline part), KaD, Km, Mn, Rk, SpD, SrC, Su (Spurlock part), TeC, Vn (Dallam part).	12-14	90	Good -----	14	80	Good -----
Group 2: Fr (Fallsam part), La, Lr (La Brier part), Sh, Tn, Ve.	12	90	Good -----	12	100	Good -----
Group 3: Bk, Gt (Guy part), VaD, Vn (Vingo part).	10-12	80	Good -----	12	90	Fair -----
Group 4: CnC, Cp (Carnero part), EsC, L+D.	8-12	70	Fair -----	8-12	70	Good -----

terial is sand, loamy sand, gravelly loamy sand, gravelly sandy loam, or sandy loam. Permeability is moderately rapid to very rapid.

Young plants need to be protected from wind and blowing sand. They also need to be watered often enough to keep the material below the surface layer moist.

WINDBREAK GROUP 4

Soil series in this group are Carnero, Escabosa, and Little. The soils are moderately deep and well drained. Below the surface layer the material is loam, silty clay loam, or clay loam. The soils in this group have a restrictive layer of hard sandstone or soft shale at a depth of 20 to 40 inches. Permeability is slow to moderate.

Plants selected for use in these soils need to have root systems that are adapted to moderately deep soils

in the county. In addition to this, many resident and migratory songbirds, as well as hawks and eagles, have made their homes in the county. Also, snakes, lizards, salamanders, toads, and tortoises are commonly found in suitable habitats.

A limited number of aquatic habitats are in Union County. The Cimarron River, one of the main means of drainage, flows year around only in upstream reaches. This river supports a small fishery near Folsom Falls. Tramperos Creek and a number of constructed ponds provide fish habitats and resting areas for migratory waterfowl. The flow of Ute Creek is short lived; thus, it does not support aquatic habitats of any appreciable significance. The New Mexico Department of Game and Fish owns Clayton Lake and manages it for public fishing and as a waterfowl refuge. Also, a small number of private ponds are

for species suitability

Ponderosa pine			Russian-olive			Siberian elm		
Height	Survival	Vigor	Height	Survival	Vigor	Height	Survival	Vigor
<i>Ft</i>	<i>Pct</i>		<i>Ft</i>	<i>Pct</i>		<i>Ft</i>	<i>Pct</i>	
16-18	70	Fair -----	16-20	60	Fair -----	20-25	80	Fair.
18	90	Good -----	12	85	Fair -----	36	100	Good.
20-22	80	Good -----	15-20	75	Good -----	22-26	85	Good.
12-16	50	Fair -----	12	70	Fair -----	18	80	Fair.

Grain and seed crops.—Domestic grain or other seed producing annuals that are planted to produce wildlife food. Examples are corn, sorghum, wheat, barley, millet, and sunflowers.

Grasses and legumes.—Perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescues, wheatgrasses, brome, orchardgrass, clovers, alfalfa, and sweetclover.

Wild herbaceous plants.—Native or established range grasses and forbs that provide food and cover for wildlife. Examples are grama grasses, wheat-

Open land wildlife.—Birds and mammals that generally frequent cropland, pastures, meadows, and other farm associated areas. Examples are bobwhite quail, ring-necked pheasant, mourning dove, cottontail rabbit, skunk, and housefinch. The habitat elements considered for open land wildlife were grain and seed crops, domestic grasses and legumes, wild herbaceous plants, and shrubs.

Wetland wildlife.—Birds and mammals that generally frequent swamp, marsh, riparian, and open water areas. Examples are kingfisher; marsh wren; muskrat

TABLE 5.—Suitability of the soils

Soil mapping units and symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Alicia loam, 3 to 9 percent slopes: AcD	Fair	Good	Fair
Apache-Rock outcrop complex: Ap	Very poor	Very poor	Poor
Aridic Haplustolls-Rubble land complex: Ar	Very poor	Very poor	Fair
Ayon-Apache association: Ay			
Ayon cobbly clay loam	Poor	Fair	Fair
Apache cobbly loam	Poor	Poor	Fair
Bandera association: Bd			
Bandera gravelly silt loam	Poor	Fair	Fair
Cinder land	Very poor	Very poor	Very poor
Bankard loamy sand: Bk	Poor	Fair	Fair
Capulin loam, 0 to 5 percent slopes: CaC	Fair	Good	Fair
Capulin-Apache complex: Ch	Poor	Poor	Fair
Carnero loam, 0 to 5 percent slopes: CnC	Poor	Fair	Fair
Carnero-Partri complex: Cp	Poor	Fair	Fair
Colmor silty clay loam, 0 to 5 percent slopes: CrC	Fair	Good	Fair
Dalcán-Rock outcrop complex: Da	Very poor	Very poor	Fair
Dallam loamy sand, 0 to 5 percent slopes: DhC	Fair	Good	Fair
Dallam fine sandy loam, 0 to 5 percent slopes: DmC	Fair	Good	Fair
Des Moines-Rock outcrop complex: Dr	Very poor	Good	Fair
Dioixce loam, 0 to 5 percent slopes: DxC	Fair	Good	Fair
Escabosa loam, 3 to 5 percent slopes: EsC	Poor	Fair	Fair
Fallsam-Rock outcrop complex: Fr	Very poor	Very poor	Fair
Gruver loam: Gr	Fair	Good	Fair
Guy-Texline complex: Gt	Poor	Fair	Fair
Kim sandy loam, 1 to 9 percent slopes: KaD	Fair	Good	Fair
Kim-Manzano association: Km	Fair	Good	Fair
La Brier silty clay loam: La	Poor	Poor	Fair
La Brier-Rock outcrop complex: Lr	Poor	Poor	Fair
Little clay loam, 1 to 9 percent slopes: LtD	Poor	Fair	Fair
Manzano loam: Mn	Fair	Good	Fair
Plack loam, 0 to 9 percent slopes: PkD	Very poor	Very poor	Poor
Raton-Rock outcrop complex: Ra	Very poor	Very poor	Poor
Rickmore sandy loam: Rk	Fair	Good	Fair
Rizozo-Rock outcrop complex: Rz	Very poor	Very poor	Poor
Sherm clay loam: Sh	Poor	Poor	Fair
Spurlock loamy sand, 1 to 9 percent slopes: SpD	Poor	Fair	Fair
Spurlock loam, 1 to 5 percent slopes: SrC	Poor	Fair	Fair
Spurlock-Plack complex: Su	Poor	Fair	Fair
Texline loam, 1 to 5 percent slopes: TeC	Fair	Good	Fair
Torreón silty clay loam: Tn	Poor	Poor	Fair
Travessilla-Rock outcrop complex, 0 to 15 percent slopes: TrE	Very poor	Very poor	Poor
Travessilla-Rock outcrop complex, 30 to 75 percent slopes: TrF	Very poor	Very poor	Poor
Ustolls-Rock outcrop association: Ur			
Ustolls	Very poor	Very poor	Fair
Rock outcrop	Very poor	Very poor	Very poor
Valent loamy sand, 3 to 9 percent slopes: VaD	Poor	Fair	Fair
Vermejo silty clay loam: Ve	Poor	Fair	Fair
Vingo-Dallam complex: Vn	Poor	Fair	Fair

Ratings for the suitability of each soil for wildlife habitat elements, as well as for the three general types of wildlife habitats, are based on the potential of the soil and not on its present use.

In table 5 the suitability of each of the soils in Union County is rated for the elements of wildlife habitat and the three general types of wildlife.

Engineering ⁷

This section is useful to those who need information

about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bed-

[illegible]

7. *Fraxinus americana* L. - white ash

5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross country movement of vehicles and construction equipment.

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series that appear in the first column of this table. Absence

Soil series and map symbols	Depth to indurated caliche or bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
Alicia: AcD -----	>60	0-73	Silty clay loam -----	CL	A-6	0
*Apache: Ap ----- Rock outcrop part too variable to rate.	4-20	0-16 16	Cobbly clay loam ----- Basalt bedrock.	CL	A-6	15-40
*Aridic Haplustolls: Ar. Too variable to rate.						
*Ayon: Ay ----- For Apache part, see Apache series.	40-60	0-11 11-42	Cobbly clay loam ----- Very cobbly loam -----	ML GM	A-7 A-2 or A-7	0-40 30-60
Bandera: Bd -----	>60	0-19 19-120	Gravelly silt loam ----- Cinders -----	ML GP	A-4 A-1	0 0
Bankard: Bk -----	>60	0-77	Sand or loamy sand -----	SM, SP-SM, SP	A-2 or A-3	0-10
*Capulin: CaC, Ch ----- For Apache part in Ch, see Apache series.	>40	0-41 41-66	Loam or clay loam ----- Cobbly loam -----	CL CL	A-6 or A-7 A-6 or A-7	0-25 15-60
*Carnero: CnC, Cp ----- For Partri part in Cp, see Partri series.	20-40	0-9 9-28 28	Loam or clay loam ----- Heavy clay loam or clay ----- Sandstone bedrock.	CL CL	A-6 A-6 or A-7	0-5 0-5
Colmor: CrC -----	>40	0-44 44	Silty clay loam and clay loam. Sandstone.	CL	A-6 or A-7	0
*Dalcan: Da ----- Rock outcrop part too variable to rate.	20-40	0-31 31	Very cobbly silty clay loam and very cobbly clay. Andesite bedrock.	CH, CL, SC or GC	A-6 or A-7	50-90
Dallam: DhC ----- DmC ----- DhC, DmC -----	>80	0-11 0-11 11-72	Loamy sand ----- Fine sandy loam ----- Sandy clay loam -----	SM SM SC or CL	A-2 A-2 or A-4 A-6	0 0 0
*Des Moines: Dr ----- Rock outcrop part too variable to rate.	>40	0-18 18-48	Very cobbly silty clay loam. Very stony silty clay -----	CL CL, CH, GC	A-6 A-7	30-75 50-90
Dioxice: DxC -----	>40	0-24 24-46 46	Silty clay loam and clay loam. Loam ----- Indurated caliche.	CL CL	A-6 or A-7 A-6	0 0-15
Escabosa: EsC -----	20-40	0-36 36	Loam or clay loam ----- Sandstone bedrock.	CL or CL-ML	A-6 or A-4	2-20
*Fallsam: Fr ----- Rock outcrop part too variable to rate.	>40	0-9 9-46	Cobbly silty clay loam ----- Very cobbly clay -----	CL CL or CH	A-6 A-7	50-80 50-90
Gruver: Gr -----	>60	0-80	Clay loam or sandy clay loam.	CL	A-7 or A-6	0

significant to engineering

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-of an entry in a column indicates that properties are not estimated. < = less than; > = more than]

Percentage passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
95-100	95-100	90-100	75-90	25-40	10-15	In/hr 0.2-0.6	In/in 0.14-0.17	pH 7.9-8.4 (0-32") 8.5-9.0 (32-73")	Moderate --	Moderate --	Low.
80-100	75-95	65-90	50-75	30-40	10-20	0.6-2.0	0.11-0.16	7.9-8.4	Low -----	Moderate --	Low.
70-100 35-60	70-100 30-55	70-100 25-50	65-95 15-40	40-50 40-50	10-20 10-20	0.6-2.0 0.6-2.0	0.10-0.17 0.06-0.10	7.4-7.8 7.9-8.4	Moderate -- Low or moderate.	Moderate -- Moderate --	Low. Low.
70-80 15-35	65-75 10-30	55-70 5-15	50-60 0-5	20-30	0-5 NP	0.6-2.0 6.0-20.0	0.10-0.16	6.6-8.4	Low ----- Low -----	Moderate -- Low -----	Low. Low.
80-100	70-100	50-80	0-15	-----	NP	6.0-20.0	0.05-0.10	6.6-7.8	Low -----	Low -----	Low.
80-100 75-100	80-100 70-95	75-100 70-90	50-90 50-80	35-50 30-45	15-25 15-20	0.6-2.0 0.6-2.0	0.12-0.16 0.08-0.14	7.4-8.4 7.9-8.4	Moderate -- Low -----	Moderate -- Moderate --	Low. Low.
95-100 85-100	95-100 80-100	90-100 80-100	50-80 60-90	20-35 35-50	10-20 20-30	0.2-0.6 0.06-0.2	0.13-0.17 0.13-0.17	6.6-7.3 6.6-7.3	Moderate -- High -----	Moderate -- Moderate --	Low. Low.
100	100	90-100	75-90	30-45	10-20	0.2-0.6	0.15-0.19	7.9-8.4	Moderate --	Moderate --	Low.
60-95	55-90	50-85	45-80	30-55	10-30	0.06-0.2	0.05-0.10	6.6-7.3	Moderate --	Moderate --	Low.
100 100 100	100 100 95-100	70-95 80-95 80-95	15-35 30-50 35-55	----- 15-25 25-40	NP NP 10-25	6.0-20.0 2.0-6.0 0.6-2.0	0.05-0.10 0.06-0.14 0.14-0.18	7.4-7.8 7.4-7.8 7.4-8.4	Low ----- Low ----- Low or moderate.	Low ----- Low ----- Moderate --	Low. Low. Low.
60-95	55-85	50-80	50-75	30-40	10-15	0.06-2.0	0.06-0.11	6.6-7.3	Moderate --	Moderate --	Low.
60-95	55-95	50-90	45-80	40-60	15-35	0.06-0.2	0.05-0.11	6.6-7.8	Moderate --	Moderate --	Low.
95-100	90-100	85-100	65-85	35-45	15-20	0.6-2.0	0.15-0.19	7.4-8.4	Moderate --	High -----	Low.
85-100	80-95	75-90	50-75	30-40	10-20	0.6-2.0	0.12-0.16	7.9-8.4	Low -----	High -----	Low.
85-100	60-95	55-90	50-80	25-35	5-15	0.6-2.0	0.11-0.18	7.9-8.4	Low or moderate.	High -----	Low.
65-100 65-100	60-95 60-95	55-85 55-90	50-80 50-85	30-40 40-60	15-25 25-40	0.2-0.6 0.06-0.2	0.07-0.12 0.03-0.10	6.6-7.3 6.6-7.3	Moderate -- Moderate --	Moderate -- High -----	Low. Low.
100	100	85-100	50-80	25-50	10-30	0.2-0.6	0.13-0.19	6.6-8.4	Moderate --	Moderate --	Low.

TABLE 6.—Estimated soil properties

Soil series and map symbols	Depth to indurated caliche or bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
	<i>In</i>	<i>In</i>				
*Guy: Gt ----- For Texline part in Gt, see Texline series.	>60	0-60	Gravelly sandy loam -----	SM or SC-SM	A-2	0-20
*Kim: KaD, Km ----- For Manzano part of Km, see Manzano series.	>60	0-60	Loam, clay loam or sandy clay loam.	CL or CL-ML	A-6 or A-4	0-5
*La Brier: La, Lr ----- For Fallsam part of Lr, see Fallsam series. Rock outcrop part of Lr too variable to rate.	>60	0-77	Silty clay loam or clay ---	CL or CH	A-7	0
Litle: LtD -----	20-30	0-22 22-40	Heavy silty clay loam ----- Soft shale.	CL or CH	A-6 or A-7	0
Manzano: Mn -----	>60	0-63	Loam, clay loam and silty clay loam.	CL	A-6	0-5
Partri ----- Mapped only in complex with Carnero.	>40	0-48 48	Clay ----- Sandstone.	CL	A-7 or A-6	0-10
Plack: PkD -----	4-20	0-12 12	Loam ----- Indurated caliche.	CL-ML or CL	A-4 or A-6	0
*Raton: Ra ----- Rock outcrop part too variable to rate.	8-20	0-9 9-18 18	Cobbly silt loam ----- Very cobbly clay ----- Basalt bedrock.	CL, CL-ML CL or CH	A-4 or A-6 A-7	15-85 50-70
Rickmore: Rk -----	>80	0-13	Sandy loam or loamy sand.	SM	A-2 or A-4	0
		13-93	Clay loam and sandy clay loam.	CL	A-6 or A-7	0
*Rizozo: Rz ----- Rock outcrop part too variable to rate.	4-15	0-10 10	Loam or silt loam ----- Sandstone bedrock.	CL-ML or ML	A-4	5-20
Rock outcrop. Mapped only in complex with other soils. Too variable to rate.						
Rubble land. Mapped in complex with Aridic Haplustolls. Too variable to rate.						
Sherm: Sh -----	>80	0-21	Clay -----	CH or CL	A-7	0
		21-90	Clay loam -----	CL	A-6 or A-7	0
Spurlock:						
SpD -----		0-16	Loamy sand -----	SM	A-2	0
SrC, Su -----		0-16	Loam or clay loam -----	CL, CL-ML	A-4 or A-6	0
SpD, SrC, Su -----	>60	16-60	Clay loam -----	CL	A-6	0
Texline: TeC -----	>60	0-96	Clay loam -----	CL	A-6	0
Torreon: Tn -----	>40	0-25	Clay -----	CL or CH	A-7	0-5
		25-72	Silty clay loam -----	CL	A-6 or A-7	0-5
*Travessilla: TrE, TrF ----- Rock outcrop part too variable to rate.	4-20	0-8 8	Sandy loam ----- Sandstone bedrock.	SM	A-4 or A-2	0-15

significant to engineering—Continued

Percentage passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink swell potential	Corrosivity	
No. 4 (4.75 mm)	No. 10 (2.0 mm)	No. 40 (0.425 mm)	No. 200 (0.075 mm)							Uncoated steel	Concrete
						In/hr	In/in	pH			
65-90	55-85	40-70	20-35	20-35	5-10	2.0-6.0	0.05-0.10	7.9-8.4	Low -----	High -----	Low.
90-100	90-100	85-100	50-80	25-40	5-15	0.6-2.0	0.15-0.17	7.4-8.4	Moderate --	Moderate --	Low.
100	100	95-100	85-100	40-55	20-30	<0.06	0.14-0.18	7.9-8.4	High -----	High -----	Low.
100	100	90-100	85-100	30-55	10-30	0.06-0.2	0.15-0.18	7.9-8.4	High -----	High -----	Moderate.
95-100	95-100	85-100	60-80	25-40	10-20	0.2-0.6	0.13-0.19	6.6-8.4	Moderate --	Moderate --	Low.
90-100	90-100	90-100	65-95	35-50	20-30	0.2-0.6	0.13-0.18	6.6-8.4	High -----	High -----	Low.
90-100	90-100	80-95	50-70	20-30	5-15	0.6-2.0	0.10-0.17	7.9-8.4	Moderate --	Moderate --	Low.
90-100 80-95	85-90 75-90	80-90 70-90	65-80 65-85	25-35 45-55	5-15 20-30	0.2-0.6 0.06-0.2	0.06-0.10 0.06-0.08	6.6-7.3 6.6-7.3	Moderate -- Moderate --	Low ----- High -----	Low. Low.
100	100	90-95	20-50	-----	NP	2.0-6.0	0.06-0.12	7.4-7.8	Low -----	Low -----	Low.
100	100	90-95	50-80	30-50	15-30	0.2-0.6	0.13-0.18	7.4-8.4	Moderate --	Moderate --	Low.
70-95	60-90	55-85	50-80	20-35	5-10	2.0-6.0	0.13-0.16	7.9-8.4	Moderate --	Moderate --	Low.
100 95-100	95-100 95-100	95-100 95-100	80-95 75-90	40-55 35-50	20-35 20-30	<0.06 0.06-0.2	0.14-0.16 0.13-0.17	6.6-7.8 7.9-8.4	High ----- Moderate --	High ----- High -----	Low. Low.
100 95-100 95-100	100 90-100 85-100	70-95 85-95 85-95	15-35 50-70 50-70	----- 20-35 25-35	NP 5-15 10-20	6.0-20.0 0.6-2.0 0.6-2.0	0.05-0.10 0.12-0.18 0.12-0.18	7.4-7.8 7.4-7.8 7.9-8.4	Low ----- Low ----- Moderate --	Moderate -- Moderate -- Moderate --	Low. Low. Low.
100	100	90-100	50-80	25-35	10-20	0.6-2.0	0.13-0.18	7.4-8.4	Moderate --	Moderate --	Low.
									High	High	Low.

TABLE 6.—Estimated soil properties

Soil series and map symbols	Depth to indurated caliche or bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
*Ustolls: U_r ----- Rock outcrop part too variable to rate.	<i>In</i>	<i>In</i>				
Valent: V_{aD} -----	>60	0-94	Sand or loamy sand -----	SM, SP or SP-SM	A-2 or A-3	0
Vermejo: V_e -----	>40	0-66	Clay or silty clay -----	CH or CL	A-7	0
*Vingo: V_n ----- For Dallam part in V_n , see Dallam series.	>80	0-11 11-80	Loamy sand ----- Sandy loam -----	SM SM	A-2 A-2 or A-4	0 0

¹ NP = Nonplastic.

neering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 6 and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meanings to soil scientists not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering Soil Classification Systems

according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 8; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the survey area.

Soil Properties Significant to Engineering

Several engineering soil properties are significant to highway construction and maintenance. These are listed in table 9.

significant to engineering—Continued

Percentage passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						In/hr	In/in	pH			
100	100	90-100	0-30	-----	NP	>20.0	0.05-0.10	6.6-7.8	Low -----	Low -----	Low.
100	100	95-100	80-95	45-55	20-30	<0.06	0.13-0.16	7.9-9.0	High -----	High -----	Moderate.
100	100	70-100	15-25	-----	NP	6.0-20.0	0.06-0.10	6.6-7.8	Low -----	Low -----	Low.
100	100	80-95	25-45	20-30	NP-5	2.0-6.0	0.10-0.15	6.6-7.8	Low -----	Low -----	Low.

and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

The Unified and AASHTO columns are explained in the next section, "Engineering soil classification systems."

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from 10 to 30 percent, the material changes from

Shrink swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of the shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 6, pertains to potential soil induced chemical action that dissolves or weakens

SOIL SURVEY

TABLE 7.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series that appear in the first column of this table. See

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Alicia: AcD -----	Severe: mod- erately slow permeability	Moderate where slopes are 3 to 7 percent	Slight -----	Moderate: moderate absorption	Moderate: silty clay absorption

properties of the soils

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils]

Degree and kind of limitation for—Cont.	Suitability as a source of—			Soil features affecting—			Hydrologic soil group
Local roads and streets	Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Terraces and diversions	
Moderate: moderate shrink swell potential; CL material.	Fair: moderate shrink swell potential; CL material.	Unsuited: no sand or gravel.	Fair: silty clay loam soil.	Slopes of 3 to 9 percent; moderately slow permeability.	Low shear strength; medium compressibility; fair to good compaction characteristics.	Slopes of 3 to 9 percent; moderately slow permeability.	B
Severe: bedrock at a depth of less than 20 inches.	Poor: shallow to bedrock.	Unsuited: no sand; excess fines.	Poor: stony; shallow to rock.	Bedrock at a depth of 20 inches or less.	Bedrock at a depth of 20 inches or less.	Bedrock at a depth of 20 inches or less.	D
				More than 35	Medium shear	More than 35	B

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Colmor: CrC -----	Severe: moderately slow permeability.	Moderate where slopes are 2 to 5 percent and bedrock is at a depth of 40 to 60 inches; slight where bedrock is at a depth of more than 60 inches and slopes are 0 to 2 percent.	Slight: moderate if bedrock is at a depth of 40 to 60 inches.	Moderate: moderate shrink swell potential.	Moderate: silty clay loam.
*Dalcen: Da ----- Rock outcrop part too variable to rate. (See Rock outcrop.)	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate where slopes are 9 to 15 percent, moderate shrink swell potential; severe where slopes are 15 to 45 percent.	Severe: bedrock at a depth of 20 to 40 inches.
Dallam: DhC, DmC -----	Slight -----	Moderate: moderate permeability.	Slight -----	Moderate: moderate shrink swell potential.	Slight -----
*Des Moines: Dr ----- Rock outcrop part too variable to rate. (See Rock outcrop.)	Severe: slopes of 15 to 70 percent.	Severe: slopes of 15 to 70 percent.	Severe: slopes of 15 to 70 percent.	Severe: slopes of 15 to 70 percent.	Severe where slopes are 25 to 70 percent.
Dioxice: DxC -----	Moderate: -----	Moderate: -----	Moderate: -----	Moderate: -----	Moderate: -----

properties of the soils—Continued

Degree and kind of limitation for—Cont.	Suitability as a source of—			Soil features affecting—			Hydrologic soil group
Local roads and streets	Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Terraces and diversions	
Moderate: moderate shrink swell potential.	Fair: moderate shrink swell potential.	Unsuited: excess fines.	Fair: silty clay loam.	Bedrock below a depth of 40 inches.	Medium compressibility; low shear strength.	Moderately slow permeability.	B

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Gruver: Gr -----	Severe: mod- erately slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Moderate: clay loam.	Moderate: moderate shrink swell potential.	Moderate: clay loam.
*Guy: G+ ----- For Texline part, see Texline series.	Slight -----	Severe: mod- erately rapid permeability.	Moderate: gravelly.	Slight -----	Severe: mod- erately rapid permeability.
*Kim: KaD, Km ----- For Manganone part, see Manganone series.	Slight -----	Moderate where slopes are 2 to 3 percent.	Moderate: clay loam.	Moderate: moderate shrink swell potential.	Moderate: clay loam.

properties of the soils—Continued

Degree and kind of limitation for—Cont.	Suitability as a source of—			Soil features affecting—			Hydrologic soil group
	Local roads and streets	Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Terraces and diversions
Severe: high plasticity index.	Poor: high plasticity index.	Unsuited: excess fines.	Fair: upper 16 inches is clay loam.	Moderately slow permeability; 0 to 3 percent slopes.	Low shear strength; high compressibility.	Slopes of 0 to 3 percent; moderately slow permeability.	C
Moderate: excess plastic fines.	Fair: excess plastic fines.	Poor: excess fines.	Poor: 15 to 35 percent gravel.	Moderately rapid permeability; slopes of 1 to 9 percent.	Medium shear strength; high piping potential.	Moderately rapid permeability; slopes of 1 to 9 percent.	B
Moderate:	Fair: mod-	Unsuited:	Fair: clay	Slopes of 1 to 9	Medium to low	Short slopes of 1 to 9 per-	B

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Rickmore: Rk -----	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Moderate: clay loam.	Moderate: moderate shrink swell potential.	Moderate: clay loam.
*Rizozo: Rz ----- Rock outcrop part too variable to rate. (See Rock outcrop.)	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.
Rock outcrop: Mapped only in complex with other soils. Too variable to rate, and severe limitations or poor suitability for most uses.					
Rubble land: Mapped only in complex with Aridic Haplustolls. Too variable to rate, and severe limitations or poor suitability for most uses.					
Sherm: Sh -----	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Severe: clay --	Severe: high shrink swell potential.	Severe: clay --
Spurlock: SpD, SrC, Su ----- For Plack part of Su, see Plack series.	Slight -----	Moderate where slopes are 1 to 7 percent; moderate permeability; severe where slopes are 7 to 9 percent.	Moderate: clay loam.	Moderate: low strength.	Moderate: clay loam.
Texline: TeC -----	Slight -----	Moderate: moderate permeability.	Moderate: clay loam.	Moderate: moderate shrink swell potential.	Moderate: clay loam.
Torreón: Tn -----	Severe: slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Severe: clay --	Severe: high shrink swell potential.	Severe: clay --
*Travessilla: TrE, TrF ----- Rock outcrop part of TrE too variable to rate. (See Rock outcrop.)	Severe: bed-rock at a depth of less than 20 inches	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.	Severe: bed-rock at a depth of less than 20 inches.

properties of the soils—Continued

Degree and kind of limitation for—Cont.	Suitability as a source of—			Soil features affecting—			Hydrologic soil group
	Local roads and streets	Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Terraces and diversions
Severe: high plasticity index.	Poor: high plasticity index.	Unsuited: excess fines.	Fair: soil when mixed is sandy clay loam.	Conditions favorable.	Low shear strength; high compressibility.	Moderately slow permeability; 0 to 3 percent slopes.	C
Severe: bedrock at a depth of less than 20 inches.	Poor: limited material.	Unsuited: limited material.	Poor: limited material.	Bedrock at a depth of less than 20 inches.	Limited material; bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	D
Severe: high shrink swell	Poor: high shrink swell	Unsuited: excess fines.	Poor: clay	Conditions favorable.	Low shear strength;	Long, uniform 0 to 3 percent	D

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
*Ustolls: Ur. Too variable to rate, and severe limitations or poor suitability for most uses.					
Valent: VaD -----	Slight -----	Severe: very rapid permeability.	Severe: sand.	Slight -----	Severe: sand; very rapid permeability.
Vermejo: Ve -----	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Severe: clay --	Severe: high shrink swell potential.	Severe: clay --
*Vingo: Vn ----- For Dallam part in Vn, see Dallam series.	Slight -----	Severe: moderately rapid permeability.	Slight -----	Slight -----	Slight -----

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use and have limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable, but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance is required.

Soil suitability is rated by the terms *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

In the following paragraphs are explanations of some of the columns in table 7.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

compacted to medium density so the area surrounding the pond will be protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope. If the floor needs to be leveled, depth to bedrock is an important consideration. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification system, and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or large stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 7, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to ease of excavation and to capacity to support load and resist settlement under load. Soil properties that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks. Properties that affect capacity to support load are wetness, sus-

properties of the soils—Continued

Degree and kind of limitation for—Cont.	Suitability as a source of—			Soil features affecting—			Hydrologic soil group
	Local roads and streets	Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Terraces and diversions
Slight -----	Good -----	Good to poor: sand; unsuited for gravel.	Poor: sand --	Very rapid permeability.	Medium shear strength; high piping potential; erodes easily.	Severe soil blowing hazard; very rapid permeability.	A
Severe: high shrink swell potential.	Poor: high shrink swell potential.	Unsuited: excess fines.	Poor: clay --	Conditions favorable.	Low shear strength; high compressibility.	Clay; very slow permeability.	D
Slight -----	Good -----	Poor: excess fines.	Poor: loamy sand.	Moderately rapid permeability.	Medium shear strength; high piping potential.	Severe soil blowing hazard; moderately rapid permeability.	B

The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 7 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are dug much deeper than that. For some soils, however, reliable predictions can be made to a depth of 10 or 15 feet. Nevertheless, every site should be investigated before it is selected.

content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 7 provide guidance about where to look for probable sources of these materials. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The

TABLE 8.—*Engineering*

[Tests performed by New Mexico State Highway Department and Albuquerque Testing Laboratory in accordance with

Soil name and location	New Mexico report no.	Depth from surface	Mechanical analysis ¹	
			Percentage passing sieve—	
			1 inch	$\frac{3}{8}$ inch
		<i>Inches</i>		
Bankard loamy sand: SE $\frac{1}{4}$ sec. 19, T. 27 N., R. 27 E.	71-0095	16-47		
Carnero loam: Center sec. 14, T. 23 N., R. 31 E.	7 8	0-3 13-22		100
Dallam loamy sand: 65 ft W., 0.35 mi S. of NE. corner, sec. 25, T. 24 N., R. 36 E.	5 1 3	0-9 19-41 41-55		
Guy gravelly loam: 200 ft S. of E. quarter corner, sec. 32, T. 28 N., R. 34 E.	71-0096 71-0097	0-6 14-25	100	83
Sherm clay loam: 0.6 mi W., 0.1 mi S., NE. corner, sec. 36, T. 26 N., R. 35 E.	6 4	7-14 28-48		100
Spurlock loam: 1,400 ft S., 1,400 ft W., of NE. corner, sec. 28, T. 26 N., R. 35 E.	71-0064 71-0065 71-0066	0-6 6-16 16-40		
Valent sand: SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 24 N., R. 36 E.	71-0090	7-60		
Vingo loamy sand: 1,600 ft S., 500 ft W. of N. quarter corner, sec. 28, T. 22 N., R. 36 E.	71-0086 71-0087	0-11 21-42		

¹ Mechanical analyses according to AASHTO Designation T 88 (1). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service. In the AASHTO procedure the fine material is analyzed by the hydrometer method, and the various grain sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by

and deneth to fractured or permeable bedrock or other consists of soils that absorb more than an average

test data

standard procedures of the American Association of State Highway and Transportation Officials (AASHTO) (1)]

Mechanical analysis ¹ —Continued			Classification
Percent passing sieve—Continued			

differentiated profiles in these soils are evident because clay and carbonates have accumulated below the surface.

Soils in the eastern part of the county formed mainly in sediment derived from the Ogallala Formation of the Tertiary geologic system. This Formation consists of sandy deposits in which Dallam and Vingo soils formed; calcareous sediment in which Guy, Plack, and Spurlock soils formed; and clayey deposits in

are deep. Torreon and Capulin soils have not only allowed water to soak in but have also received additional eolian sediment and alluvium; as a result, these level to gently sloping soils are deep and have distinct horizons. La Brier and Manzano soils are level to nearly level. They absorb most of the precipitation that falls directly on them and receive additional moisture in the form of runoff from surrounding areas. Because of this, the dark surface layer that is about 10

which Gruver, La Brier, Rickmore, and Sherm soils formed. These soils, especially in the layers beneath the surface layer, commonly reflect the texture and color of the parent material. The color of the surface layer commonly reflects the amount of organic matter in the soil. For example, Sherm and La Brier soils are dark grayish brown or very dark grayish brown and have more organic matter than the brown Dallam and Vingo soils.

The Cretaceous period left two main formations in Union County. The Graneros Shale is the younger, and the Dakota Formation is the older. Little soils formed in residuum weathered from the Graneros Shale; Colmer soils, in eolian material derived from it. Both of these soils are high in silt and clay, low in sand, and have the brown, yellow, and olive colors characteristic of the Graneros Shale. Travessilla, Carnero, Escabosa,

inches thick in nearby soils is more than 20 inches thick in La Brier and Manzano soils.

Travessilla and Apache soils are in steeper areas and near the edges of breaks. The slope and the shallow depth to bedrock cause them to shed much of the water that falls on them. Because soil is lost by water erosion and gravity at nearly the same rate as new soil is formed, Travessilla and Apache soils are likely to remain shallow to bedrock.

Plant and Animal Life

All forms of life—micro-organisms, plants, and animals, including man—have a part in the formation of soil.

The soils in Union County are mostly under grass, but some steep soils at higher elevations are under trees and brush. Decomposing roots of all kinds have

and Partri soils formed in the dominantly hard sandstone of the Dakota Formation.

Red sandstone and interbedded shale formations of

furnished the organic matter that makes the surface layer dark. In some soils grass roots also have influenced the structure of the surface layer.

the Jurassic and Triassic periods are exposed in eroded areas near the Cimarron River. Rizo soils, which formed in residuum, and Alicia soils, which formed in alluvium, have retained the reddish color of the sandstone from these geologic formations.

Climate

Union County has the semiarid continental climate typical of drier parts of the Southern High Plains and most parts of the Pecos-Canadian Plains and Valleys major land resource areas (3). The climate is characterized by abundant sunshine: by wide seasonal

In a few areas buffalo wallows are still visible and are mapped as included soils in areas of Carnero and Capulin soils. Prairie dogs and other burrowing animals commonly mix the soil because their tunnels extend through more than one soil horizon in most places.

Man has had a definite influence in this area. In much of Union County, homesteaders removed the natural plant cover from the soil as they plowed the fields for their crops. This left the soil more susceptible to erosion, reduced the content of organic matter, and changed the physical condition of the surface layer.

TABLE 9.—*Classification of soil series by higher categories*

Series	Family	Subgroup	Order
Alicia	Fine-silty, mixed mesic	Ustollic Camborthids	Aridisols.
Apache	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Ayon	Loamy-skeletal, mixed, mesic	Aridic Calciustolls	Mollisols.
Bandera	Cindery	Torriorthentic Haploborolls	Mollisols.
Bankard	Sandy, mixed, mesic	Ustic Torrifluvents	Entisols.
Capulin	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Carnero	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Colmor	Fine-silty, mixed, mesic	Aridic Calciustolls	Mollisols.
Dalcan	Clayey-skeletal, montmorillonitic	Pachic Argiborolls	Mollisols.
Dallam	Fine-loamy, mixed, mesic	Aridic Paleustalfs	Alfisols.
Des Moines	Clayey-skeletal, montmorillonitic	Pachic Argiborolls	Mollisols.
Dioxide	Fine-loamy, mixed, mesic	Aridic Calciustolls	Mollisols.
Escabosa	Fine-loamy, mixed, mesic	Aridic Calciustolls	Mollisols.
Fallsam	Clayey-skeletal, montmorillonitic, mesic	Pachic Argiustolls	Mollisols.
Gruver	Fine, mixed, mesic	Aridic Paleustolls	Mollisols.
Guy	Coarse-loamy, mixed, mesic	Aridic Calciustolls	Mollisols.
Kim	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
La Brier	Fine, mixed, mesic	Torrertic Argiustolls	Mollisols.
Litle	Fine, mixed, mesic	Ustollic Camborthids	Aridisols.
Manzano	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Partri	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Plack	Loamy, mixed, mesic, shallow	Petrocalcic Calciustolls	Mollisols.
Raton	Clayey-skeletal, mixed	Lithic Argiborolls	Mollisols.
Rickmore	Fine, mixed, mesic	Aridic Paleustalfs	Alfisols.
Rizozo	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Sherm	Fine, mixed, mesic	Torrertic Paleustolls	Mollisols.
Spurlock ¹	Coarse-loamy, carbonatic, mesic	Ustollic Calciorthids	Aridisols.
Texline	Fine-loamy, mixed, mesic	Calciorthidic Paleustolls	Mollisols.
Torreon	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Travessilla	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Valent	Mixed, mesic	Ustic Torripsamments	Entisols.
Vermejo	Fine, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Vingo	Coarse-loamy, mixed, mesic	Aridic Paleustalfs	Alfisols.

¹These soils are homologous to the Spurlock series. Other than an argillic horizon, and they are drier than is defined in the

great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons, soil moisture and temperature regimes, and in base status.

Subgroup Great groups are subdivided into three

instead of the fine particle size characteristic of Gruver soils.

Some of the soils joining Union County from Cimarron County, Oklahoma, to the east have different

TABLE 10.—*Temperature and precipitation*

[All data from Clayton. Period of record, 1931-60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average	One year in 10 will have—		Average number of days with precipitation of—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	0.10 inch or more	0.25 inch or more
	°F	°F	°F	°F	Inches	Inches	Inches		
January -----	46	20	65	3	0.4	(¹)	0.8	1	(²)
February -----	49	23	68	6	.4	(¹)	.7	1	(²)
March -----	55	27	75	11	.6	(¹)	1.6	2	1
April -----	65	37	82	24	1.2	0.2	2.9	3	1
May -----	73	46	88	35	2.7	.5	5.6	5	3
June -----	84	56	95	47	1.5	.4	3.3	3	2
July -----	88	61	97	54	2.3	.7	5.0	5	3
August -----	87	60	95	53	2.1	.8	3.4	4	2
September -----	80	53	91	40	1.6	.2	3.8	3	2
October -----	69	41	83	27	1.0	.1	3.0	2	1
November -----	55	28	74	14	.3	(¹)	1.0	1	(²)
December -----	49	23	68	9	.4	(¹)	.7	1	(²)
Year -----	67	40	³ 99	⁴ -3	14.5	8.3	19.3	31	15

¹ Less than 0.05 inch.
² Less than one-half day.

³ Average annual highest temperature.
⁴ Average annual lowest temperature.

The transportation facilities provided by the railroad built in the 1880's also contributed much to the early settlement of Union County. Clayton became an

Conservation Needs Committee estimated that about 28,200 acres were irrigated in 1966. Although small areas are irrigated by water diverted from the Cimar-

fall because moist air from the Pacific Ocean comes down from the mountains and

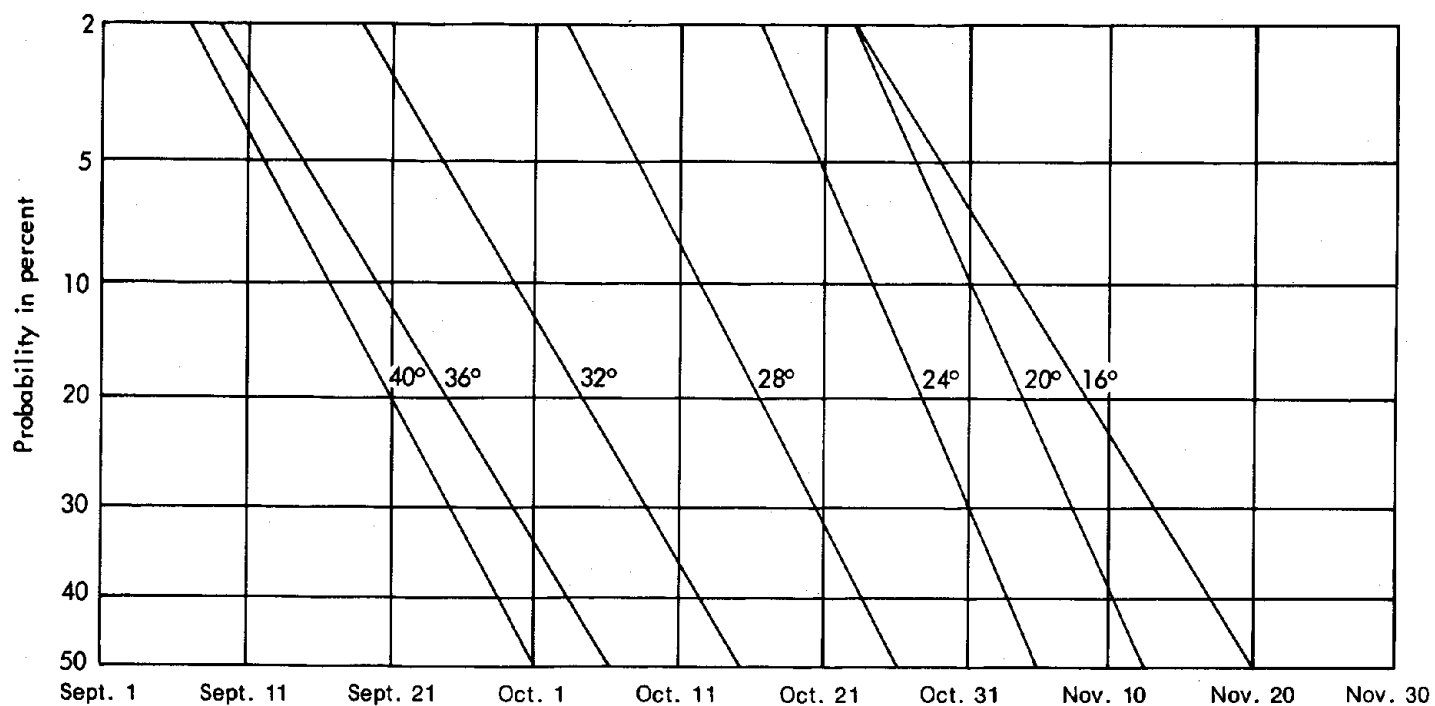
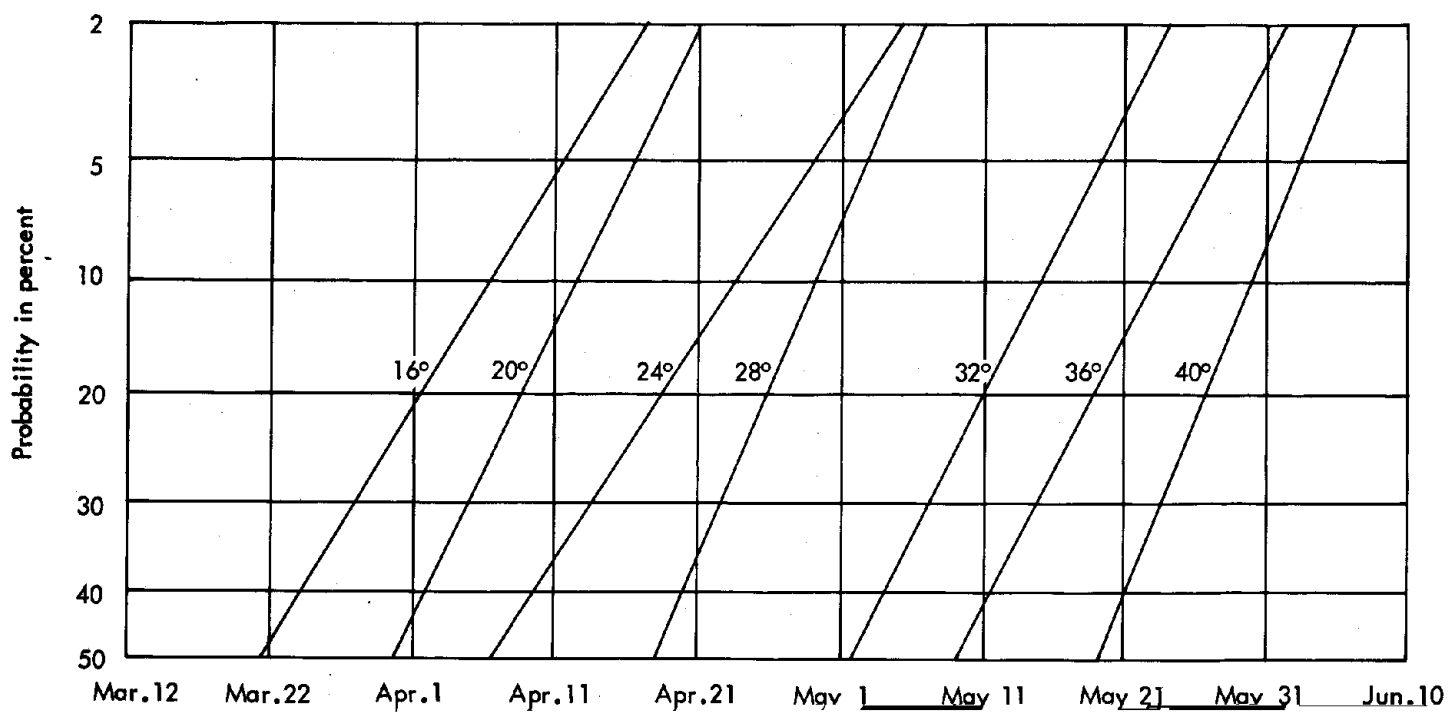


Figure 20.—Probability of occurrence of selected low temperatures at various dates in spring and in fall.

- way materials and methods of sampling and testing. Ed. 10, 2 vol., illus.
- (2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. In 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.
 - (3) Austin, Morris E. 1965. Land resource regions and major land resource areas of the United States. U.S. Dep. Agric. Handb. 296, 82 pp., map.
 - (4) Baldwin, Brewster, and Bushman. 1957. Guides for development of irrigation wells near Clayton, Union County, New Mexico. N. M. Bur. Mines, Circ. 46, 64 pp., illus.
 - (5) Meaders, Margaret. 1967. The economy of Union County: the background series. Bur. Bus. Res., N. M. Univ., 84 pp.
 - (6) Maker, H. J., H. B. Maxwell, and J.U. Anderson. 1973. Soil associations and land classification for irrigation in Union County. Agric. Exp. Sta. Res. Rep. 250, 36 pp., illus.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
- Loose.*—Noncoherent when dry or moist; does not hold together in a mass.
- Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
- Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
- Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
- Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
- Hard.*—When dry moderately resistant to pressure.

high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream or portion of a stream that flows only in direct response to precipitation.

Forb. Any herbaceous plant not a grass or a sedge.

Horizon, soil. A layer of soil, approximately parallel to the

Residum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile char-

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series of which it is a part. When referring to a capability unit, a range site, or a windbreak group, read the section it is in for general information about its management.

Map symbol	Mapping Unit	Page	Irrigated capability unit	Dryland capability unit or subclass	Range site	Windbreak group
			Symbol	Symbol	Name	Number
AcD	Alicia loam, 3 to 9 percent slopes-----	9	IVe-6	VIe	Loamy	1
Ap	Apache-Rock outcrop complex-----	10	-----	VIIIs	-----	-
	Apache cobbly loam-----	--	-----	-----	Malpais	5
	Rock outcrop-----	--	-----	-----	-----	-
Ar	Aridic Haplustolls-Rubble land complex-----	11	-----	VIIIs	-----	-
	Aridic Haplustolls-----	--	-----	-----	Breaks	5
	Rubble land-----	--	-----	-----	-----	-
Ay	Ayon-Apache association-----	11	-----	VIIIs	Malpais	5
Bd	Bandera association-----	12	-----	-----	-----	-
	Bandera gravelly silt loam-----	--	-----	VIe	Cinder	5
	Cinder land-----	--	-----	VIIIs	-----	-
Bk	Bankard loamy sand-----	13	-----	VIe	Deep Sand	3
CaC	Capulin loam, 0 to 5 percent slopes-----	14	IIIe-6	IVe-2	Loamy	1
Ch	Capulin-Apache complex-----	14	-----	VIIs	-----	-
	Capulin loam-----	--	-----	-----	Loamy	1
	Apache cobbly loam-----	--	-----	-----	Malpais	5
	Ayon cobbly clay loam-----	--	-----	-----	Malpais	5
CnC	Carnero loam, 0 to 5 percent slopes-----	15	IIIe-9	VIe	Loamy	4
Cp	Carnero-Partri complex-----	15	IIIe-9	VIe	Loamy	-
	Carnero loam-----	--	-----	-----	-----	4
	Partri silty clay loam-----	--	-----	-----	-----	1
CrC	Colmor silty clay loam, 0 to 5 percent slopes-----	16	IVe-6	IVe-2	Clayey	1
Da	Dalcan-Rock outcrop complex-----	17	-----	VIIIs	-----	-
	Dalcan cobbly silt loam-----	--	-----	-----	Mountain Grassland	5
	Rock outcrop-----	--	-----	-----	-----	-
DhC	Dallam loamy sand, 0 to 5 percent slopes---	18	IIIe-10	IVe-3	Deep Sand	1
DmC	Dallam fine sandy loam, 0 to 5 percent slopes-----	18	IIIe-4	IVe-1	Sandy	1
Dr	Des Moines-Rock outcrop complex-----	19	-----	VIIIs	-----	-
	Des Moines cobbly silt loam-----	--	-----	-----	Mountain Grassland	5
	Rock outcrop-----	--	-----	-----	-----	-
DxC	Dioxice loam, 0 to 5 percent slopes-----	20	IIIe-6	IVe-1	Loamy	1
EsC	Escabosa loam, 3 to 5 percent slopes-----	21	-----	VIe	Shallow	4

GUIDE TO MAPPING UNITS-CONTINUED

Map symbol	Mapping unit	Page	Irrigated capability unit	Dryland capability unit or subclass	Range site	Windbreak group
			Symbol	Symbol	Name	Number
LtD	Little clay loam, 1 to 9 percent slopes-----	29	-----	VIe	Clayey	4
Mn	Manzano loam-----	29	IIE-6	IVe-2	Loamy	1
PkD	Plack loam, 0 to 9 percent slopes-----	30	-----	VIIIs	Shallow	5
Ra	Raton-Rock outcrop complex-----	31	-----	VIIIs	-----	-
	Raton cobbly silty loam-----	--	-----	-----	Malpais	5
	Rock outcrop-----	--	-----	-----	-----	-
Rk	Rickmore sandy loam-----	32	IIIe-4	IIIe-3	Sandy	1
Rz	Rizozo-Rock outcrop complex-----	33	-----	VIIIs	-----	-
	Rizozo loam-----	--	-----	-----	Shallow	5
	Rock outcrop-----	--	-----	-----	Sandstone	-
Sh	Sherm clay loam-----	34	IIIe-8	IIIe-2	Clayey	2
SpD	Spurlock loamy sand, 1 to 9 percent slopes--	35	-----	VIe	Deep Sand	1
SrC	Spurlock loam, 1 to 5 percent slopes-----	35	IIIe-12	VIe	Sandy	1
Su	Spurlock-Plack complex-----	35	-----	VIe	-----	-
	Spurlock loam-----	--	-----	-----	Sandy	1
	Plack loam-----	--	-----	-----	Shallow	5
TeC	Texline loam, 1 to 5 percent slopes-----	36	IIIe-6	IVe-1	Loamy	1
Tn	Torreon silty clay loam-----	37	IIIe-8	IVe-1	Loamy	2
TrE	Travessilla-Rock outcrop complex, 0 to 15 percent slopes-----	38	-----	VIIIs	-----	-
	Travessilla sandy loam-----	--	-----	-----	Shallow	5
	Rock outcrop-----	--	-----	-----	Sandstone	-
TrF	Travessilla-Rock outcrop complex, 30 to 75 percent slopes-----	38	-----	VIIIs	-----	-
	Travessilla stony sandy loam-----	--	-----	-----	Breaks	5
	Rock outcrop-----	--	-----	-----	-----	-
Ur	Ustolls-Rock outcrop association-----	39	-----	-----	-----	-
	Ustolls-----	--	-----	VIIIs	Breaks	5
	Rock outcrop-----	--	-----	VIIIIs	-----	-
VaD	Valent loamy sand, 3 to 9 percent slopes----	40	-----	VIe	Deep Sand	3
Ve	Vermejo silty clay loam-----	40	IVs-9	VIIs	Clayey	2
Vn	Vingo-Dallam complex-----	41	IVe-10	VIe	Deep Sand	-
	Vingo loamy sand-----	--	-----	-----	-----	3
	Dallam loamy sand-----	--	-----	-----	-----	1